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T. COMMERFORD MARTIN, JOSEPH WETZLER, Associate Editors.
G. H. STOCKBRIDGE, Assoc. Editor Patent Department.
CLARENCE E. STUMP, Business Manager.
WALTER T. HUNT, Advertising Dept.

New England Office, 48 Congress Street, Boston.
W. I. BARKER, Manager.

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New Advertisements.

In the growth of THE ELECTRICAL WORLD in circulation, size and general improvement, the value of its columns for reaching those engaged in electrical pursuits or interested in electrical matters has not failed to be appreciated by advertisers. Readers will find it to their advantage to keep their eyes on the advertising as well as the reading columns. The following are the new advertisements in this issue:

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VOL. X. NEW YORK, SEPTEMBER 3, 1887. No. 10.

OUR Philadelphia correspondent sends a very interesting letter this week as to the pageant that is to be given in that city in a few weeks to celebrate the centennial of the Constitution. He is anxious that some electrical display should be included in the parade, and we trust that this will be seen to by some of our Philadelphia readers, many of whom are in a position to do the matter justice.

IN view of the great interest taken in the use of the alternating current for electric lighting, the illustrations and description which we are enabled to give this week of the Westinghouse system will be found very timely. With characteristic American energy, the system in question has been introduced and installed all over the country, so that it is already well-known as one of the most prominent bidders for public favor, even before the electrical mind has been finally made up as to its merits and advantages.

AN article by F. L. Oswald in the current number of the *North American Review* criticises very pertinently the average methods of keeping houses and offices cool in summer. As Mr. Oswald remarks, our homes, clothing and food are all adjusted as nearly as possible to a polar environment, and hence, when summer comes, as it came last July, its effects are appaling. The article does not enumerate, as it might, the electric light and the electric motor as appliances with whose assistance far greater coolness than could hitherto be enjoyed is now obtainable, but they are well within his suggestions as to means of improvement, and as practical successes were perhaps never more gratefully used than during the recent prolonged spell of humid weather through the dog days.

FROM the many ingenious electrical devices designed in the past by Mr. Philip Diehl, it might have been expected that his application of the electric motor to the sewing-machine would result in something decidedly novel. Such must be conceded to be the arrangement, illustrated on another page, in which the motor is completely removed from the sewing-table and placed within the fly-wheel. There seems to be now no good reason why this combination should not become a regular product of sewing-machine manufacture, since the large and increasing number of electric light and power stations and the available primary batteries make the motor a valuable and convenient adjunct. The idea embodied here is by no means limited to this particular case, and numerous other applications will suggest themselves to our readers.

THE important fact brought out that steel castings can now be obtained without dangerous blow holes, by the addition of aluminum, will probably be followed by a general application of cast steel, as well as an increased manufacture of aluminum-iron alloy in the electric furnace. As stated in another column, the addition of the aluminum prevents the chilling of the steel. The reason for this is to be sought in the fact that the latent heat of fusion of aluminum is very high, and it was this that gave early investigators wrong ideas in regard to its melting point. The large amount of latent heat contained within the molten aluminum is given out during the cooling process and helps to maintain the steel at a continued high temperature; or, in other words, it retards the cooling of the mass and thus prevents blow holes.

THE bucket shops are once more objects of polite attentions on the part of the regular stock and produce exchanges, and active measures to supress these peculiar institutions are threatened. In Chicago, the fight has already begun, with the result that the Board of Trade has won a decided victory, brought the telegraph companies to submission and deprived the bucket shops of their wires. In New York, there is promise of a somewhat similar campaign, in which the police and public authorities are to take part. The matter has been one of very serious consideration on the New York Stock Exchange for some time past, and now it looks as though something may be done. No defense can well be offered for the bucket shops, which are simply gambling hells, but they have been found difficult of permanent suppression so far, and the end is not yet.

WHILE the production of electricity by the combustion of coal or carbon has recently been accomplished in the pyromagnetic generator of Mr. Edison, other work has been going on to accomplish the same result through the medium of the primary battery. Mr. Case's experiments in this direction, as we have already pointed out, consisted first in making heat externally applied cause the solution of a tin salt in the electrolyte, which generated a current, and then, on allowing it to cool, the salt was precipitated. The current thus obtained was, however, intermittent and the E. M. F. of the battery comparatively low. In the new type of Case cell, which we describe in another column, carbon is actually consumed within the battery at ordinary temperatures, and the E. M. F. compares well with that of the usual cells employed. It is to be regretted, however, that the nature of the chemicals resorted to is such as to make it necessary to use caution in their handling, but perhaps other means may be devised. The application as it stands is decidedly interesting, and Mr. Case will do well to continue his experiments.

THE full description we give this week of an alternating system of electric lighting, shows the remarkable extension which a simple electrical phenomenon can obtain. While, as in the case of arc lighting, the first practical attempts were made abroad, the introduction of this system on American soil was followed by a remarkable growth and unprecedented development. What must be considered as a decided advance in the alternating system as now applied is the fact that it has been shown to be practical to introduce an iron core in the armature of the generator. It is evident that this improvement has been brought about by a thorough lamination of the armature, a precaution not taken by the early constructors of alternating current machines. By this means the weight of the machines for a given output has been largely reduced. It is interesting to note also the remarkable compactness of the converter as a transformer of energy. The converter weighs only three pounds per lamp, which is far below that of the dynamo, and makes it perhaps the lightest transformer of energy known.

THE paper read by Mr. Edison before the American Association for the Advancement of Science has called attention prominently to the subject of the production of electricity directly from heat, and as we predicted in a recent note, the "anticipations" are already beginning to come to the surface. The first of these is the experiment made some years ago by Profs. Thomson and Houston, and in bringing this forward Mr. Carl Hering points out the true spirit in which the publication of such prior work should be made; that is, it should not be mentioned in criticism of the new departure, but rather as a recognition of the labors of the previous investigators. Taking the present instance, for example, the machine of Mr. Edison, while based upon a principle similar to that in the one described, shows, nevertheless, a high degree of inventive ability and is a decided advance upon the simple device described in 1879. Nevertheless, Profs. Thomson and Houston deserve full credit for their work. We have undoubtedly still other anticipations to hear from, and in fact there seems to be a growing tendency to constitute technical papers an outside court of interference in priority claims. Certain it is that few inventions of importance are at present brought out which are not followed by the claims of prior inventors, who make the press the medium of their assertion of earlier right.

SOME time after the electric railway at Scranton, Pa., went into operation, the mayor of that town took occasion in his annual address to congratulate his fellow citizens on the success of the enterprise, and on the fact that they were so well abreast of the leading improvements of the age. The feeling of local pride thus exhibited was commendable, for a town with an electric road has at least succeeded in getting beyond the rudimentary stage of internal traffic when its inhabitants are condemned to the use of slow cars, dependent for motive power on inferior and overworked horses kept in unsavory stables. In fact, as our towns and cities advance in their ideas of urban sanitation, comfort and convenience, they strive to supplant the horse railroad by some better agency, and the superiority of electricity is more and more manifesting itself and being acknowledged for this class of work. We are not at all surprised to find the Business Men's Association at Buffalo resolving in public meeting against horse power, and expressing pleasure at the announcement of an intention to adopt other methods. This is but another indication that the tide is with the electrician, and that, though the general adoption of electric motors for street railways may seem slow, it is nevertheless sure. And, after all, is the work so slow? We do not know of any other department of applied electricity that is brisker.

THROUGH the kindness of Mr. W. J. Hammer, who has allowed us to use a copyrighted design of his, we are able to present this week a very novel and interesting table in regard to some of the motor work now being done in Boston. While it is not to be expected that the results and figures brought under notice can be freely used elsewhere as example or precedent, such a showing is very instructive and equally stimulating. Boston, as is well-known, has more than one power service, and the fact that so much work for motors is found in that city ought to encourage electricians in many other places to see what they can do. Wherever power is wanted in the vicinity of an electric light or power station, there is a chance for the motor, and although in a few localities water power reigns supreme because it is cheap, yet, taking the country—the populous centres—as a whole, the electric motor leads to-day as the machine for furnishing power to the best advantage to all but the largest consumers of it. The point is not as familiar to the general public as it should be, and we think, therefore, that President Pendleton and the other officers of the New York Electrical Society, have been farsighted and well advised in giving prominence at their Exhibition this Fall to the uses of the motor, as mentioned in our columns this week. The motor is an excellent thing, as we all know. But, like other good things, it needs to have its desirability called attention to as often, as skillfully, and as emphatically as possible, so that the users of power may not fail to learn how great a boon is at their service. The remark made by Mayor O'Brien, in Boston recently, that the electric motor might be utilized in promoting small industries there was shrewd, and its significance is already being appreciated, as the chart helps to exemplify, in that city. In other manufacturing districts the same idea is germinating, and the plans that are afoot promise ample occupation in this new but rapidly enlarging field.

NEW BOOKS.

POOR'S DIRECTORY OF RAILWAY OFFICIALS. A supplement to Poor's Manual of Railroads. 1887. Second year. 382 pages octavo. New York.

The extent of the railway system of the United States is strikingly brought out in this directory, which is intended to serve as a supplement to Poor's Manual of Railroads. It contains no fewer than 30,000 names of persons occupying important official positions in connection with the steam and street railways, and with the industries directly related thereto. It is thoroughly classified, and includes lists of general superintendents, chief engineers, master mechanics, master car-builders, passenger agents, freight agents, locomotive builders, rail mills, car-builders, car-axle manufacturers, car-wheel manufacturers, car-spring manufacturers, equipment concerns, express companies and sleeping-car companies. This enumeration will in itself show how thoroughly exhaustive the work is, and how useful it must be to all who have occasion at any time to reach any of these officials. The information with regard to street railways, we may remark, appears to be remarkably full and accurate. The book is handsomely bound and printed, and altogether worthy of the reputation of its compilers and publishers.

MANUAL OF THE MAVERICK NATIONAL BANK. Issued by the Maverick National Bank of Boston. 1887. 200 pages.

The science of political economy was once based largely upon mere assertion and opinion; to-day it rests its whole weight upon the sister science of statistics. It is often said that figures lie, but this is hardly so. It is rather the interpretation that is misleading, and not the figures themselves; and it seems to us that the more figures there are the less likely it is that any one set of them can be misused so as to serve an improper purpose. Of late years the work of such men as Mulhall, Edward Atkinson, Giffen, and Leone Levi has shown us how much of real value and interest is to be found in the longest col-

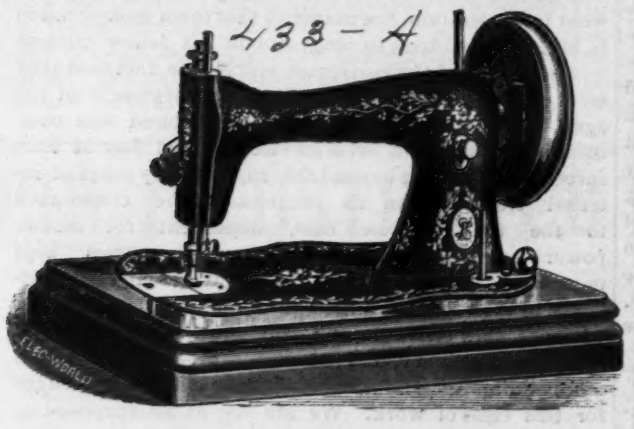


FIG. 1.—DIEHL COMBINED SEWING MACHINE AND MOTOR.

umn and the driest table of figures if they be impartially considered, if they are made to yield their lesson as to improved methods of production, distribution, and consumption, and if they inform us how to get the greatest good out of life. The taste for statistical literature is unquestionably growing, and this manual issued by the Maverick National Bank is in its way no mean contribution to the list of recent works dealing with statistics. It consists of no fewer than 200 pages, and comprises 15 chapters dealing with international, national and State finance, coinage and currency, railroads, agriculture, minerals and other elements whose figures can be brought to bear on questions of individual and general prosperity. One of the most interesting sections is to be found in chapter 13, which is devoted to electrical development. This chapter gives the fullest statistics that we have seen as to the telegraph and cable systems of the world, the use of the telephone, the spread of the electric light, and the growing use of the electric motor. It embraces also an admirable chronology of electric science and discovery from the year 1600 up to 1886. Altogether the manual is a work of the most useful character, and the bank has done a public service in preparing and publishing it.

SECOND STANDARD PHONOGRAPHIC READER. Revised. By Andrew J. Graham. 223 pp. New York. Published by the Author. Price, $1.75.

This is emphatically the age of rapidity and dispatch, and it is not to be wondered at that the increasing adoption of the telegraph should have been matched in some respects by the vogue enjoyed by stenography. In fact, in a great many departments of business life the one serves as a complement to the other, especially in America. Of late years telegraph operators have more and more shown an inclination to the study of systems of shorthand, and it is somewhat striking that several of the leading officials of our largest telegraph and railroad companies should have won their way to success] chiefly through the ability which they displayed at first in the positions of operators and stenographers.

The inquiry has been and is now often addressed to us by telegraph operators and those engaged in telephone offices as to the best system of shorthand to be studied with a view to advancement. We are not prepared to pronounce dogmatically as to the best, but we will undertake to say that no mistake can be made in studying "Standard" phonography as devised by Mr. Andrew Graham, and now practiced by a large number of the leading stenographers in this country. It was recently established by authoritative tests that with this system at least 250 words per minute could be written, and for all rates between that and 50 words per minute the system will be found entirely adequate and satisfactory. The Standard system has undergone the trial of many years, and of more than one generation of stenographers, and has to-day wider popularity than ever, as well as an extensive literature of its own. Excellent, however, as is this second edition of the Reader, we would not advise any of our friends to devote themselves to its study without having first acquired some idea of the system from the earlier and more rudimentary books, all of which are cheap, helpful and good; and though the assistance of an instructor is desirable, they are sufficient to carry a man through from the first stages to the consummate dexterity of the verbatim reporter. We can heartily recommend phonography as a study to be taken up in connection with telegraphy. The day is at hand, in fact, when it will be indispensable for the operator to be conversant with both type-writing and phonography, if he or she wishes to make any headway.

Partial Resistance of Telegraph Lines.

BY F. W. JONES.

Referring to the inquiry of "J.," on page 44 of THE ELECTRICAL WORLD, July 23, 1887, and to the two communications in reply thereto, page 68, Aug. 6, I would say that I do not think the replies are sufficiently plain and accurate to meet the wants of "J.," who seems to be one of a very numerous class that desires some simple formula and explanation to enable him to readily arrive at and understand the meaning of his observed measurements in practical work. Correct results are possible by the method shown in either of the responses, but the figures given are not correct and the methods are roundabout. The question, as asked by "J.," is as follows:

Call insulation measured from A to B, 406,824 ohms = R
" " " " A to C, 283,734 " = R_1
" " " " B to C, 937,767 " = R_2

Then, $$\frac{R \times R_1}{R - R_1} = R_2,$$

and by multiplying R, R_1, and R_2 respectively by the length of wire included in their respective measurements, the mileage insulation is given in each case.

To elucidate this, suppose a wire attached to the Wheat-

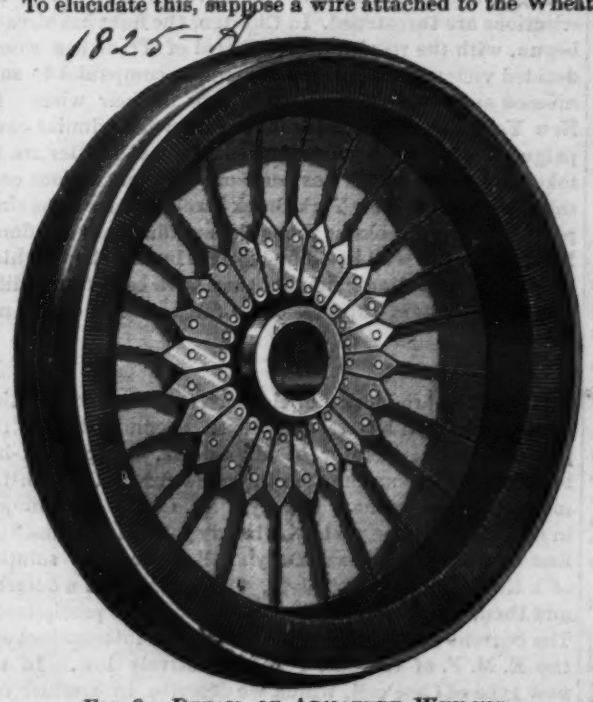


FIG. 3.—DETAIL OF ARMATURE WINDING.

stone bridge at A, with the end open at B and a measurement of the leakage gives 406,824 ohms; then connect the wire B C to A B. If it is known beforehand that the leak Y is 937,767 ohms, it is only necessary to use the well-known formula for conjoint resistances and we find the joint resistance of the two leaks X and Y, which will be

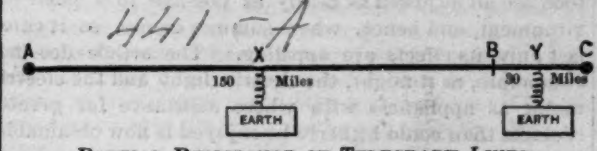
$$\frac{R \times R_2}{R + R_2} = 283{,}734 \text{ ohms};$$

and this will agree with the reading on the bridge. Now, R_1 being known and R_2 unknown, the formula

$$\frac{R \times R_1}{R - R_1} = 937{,}767 \text{ ohms},$$

gives the unknown leakage Y.

This method is open to the same objections bearing against the methods given in this journal of Aug. 6, and of which no information was then given.



PARTIAL RESISTANCE OF TELEGRAPH LINES.

To get accurate results the wire is supposed to interpose no resistance between the bridge and the leaks. This is an impossible condition, as all wires must have resistance. It is only when the wire from A to B and from B to C has a uniformly good insulation resistance at each insulator, and when the wire is of uniform gauge and good conducting capacity, that the formulas will give approximately correct results.

If the wire is poorly insulated between A and B, and the leakage is not uniformly distributed throughout its length, the measurement of B to C, when measured at A, will be made by a current diminished by the leakage at each contact between A and B, and the potential of the battery will be decreased by the resistance through which it has fallen, and the observed measurement at A of the wire B C will not be the same as if the measure was made directly from B.

It is not possible on ordinary telegraph wires to tell by measurements from A the resistance of each insulator, nor the exact joint insulation resistance of all the insulators. The most that can be determined is the resultant as recorded on the instruments at A, because, as before stated, the measuring current as it flows from A to C is weakened at each insulator on account of the derived circuit to earth. For simplicity I have shown the leakage of all the insulators between A and B and B and C, as resultant leaks in the centre of the wire Y. Such a condition hardly ever obtains; the resultant leaks will be either one side, or the other, of the centre of their respective sections.

The British Postal Telegraph Department makes daily insulation tests of its wires by received currents upon a tangent galvanometer. In this way there is no chance to be deceived as to margin of insulation necessary for the proper working of the circuits.

Diehl's Combined Sewing-Machine and Electric Motor.

There is to-day probably no domestic labor saving device in more general use than the sewing-machine, and it ranks rightly as one of the prominent inventions of this century. While, however, it saves a vast amount of manual labor,

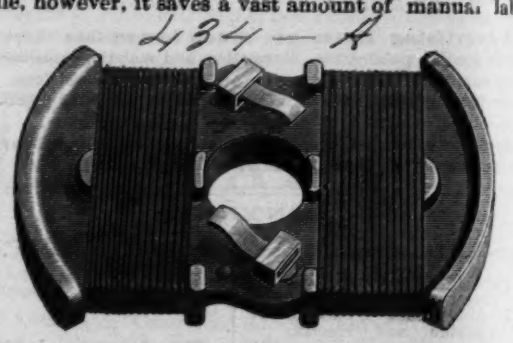


FIG. 2.—FIELD MAGNET OF MOTOR.

its continuous use for hours entailing the employment of a treadle has called for methods of driving the machines by auxiliary power, and in large factories they are frequently coupled to lines of shafting. This method of driving has not been applicable to the case of isolated machines, whether in shops or private dwellings, and hence the advent of the electric motor, which permitted each machine to be independent of any other, was welcomed because it offered a ready means of accomplishing in a convenient manner what was heretofore impracticable. The small motors have, as a rule, been attached to the board on which the sewing-machine is mounted, and then belted to the shaft of the latter.

It was to avoid the necessity of belting and at the same time to do away with the presence of an auxiliary machine on the board for driving, that Mr. Philip Diehl, of Elizabeth, N. J., several of whose ingenious devices we have already described, conceived the idea of combining the motor and sewing machine into a practical unit.

The simple and elegant manner in which he has accomplished this is shown in the engraving, Fig. 1.

The motor, it will be seen, is completely housed within the fly-wheel of the machine and connected directly with the driving shaft, so that all gearing is obviated. The details of the arrangement will be readily understood from Figs. 2 and 3, which show respectively the field magnet and armature of the motor. The magnet, which consists of a single piece, is wound with wire connected to the two terminal brushes shown. This magnet is permanently fixed to the hub through which the shaft passes. The armature shown in perspective in Fig. (3) is of the Gramme type, and is held in position within the rim of the wheel. The wires leading from the periphery connect to the commutator at the hub, and the brushes on the magnets bear against the segment.

The wires leading to the motor pass up through the hollow casting of the frame, and are connected to a switch by which the machine can be started and stopped at will. The fly-wheel is provided with a clutch or stop motion in connection with the shaft, so that it may be connected with the latter, or turned loose, as is common in sewing machines—the wheel being disconnected from the shaft when winding bobbins. This is accomplished by a turn of a thumb-nut at the rear end of the machine. By unscrewing this nut entirely, the armature may be slid out

completely, so that it may be examined should necessity require. This also exposes the field magnets and brushes so that they can be easily gotten at for examination and attention. The entire device is put together in most compact and neat form, and adds greatly to the value of the sewing-machine as a labor-saving device.

The American Institute Electrical Exhibition.

From the large number of applications which have been made for space at the coming Electrical Exhibition of the American Institute, to be opened on Sept. 28, it is evident that the display will be a most interesting and varied one.

The exhibition will be specially strong in its showing of the possibilities of the electric motor and its applications, all the prominent companies engaged in this work having applied for large space. An extensive scope of work will be brought to notice, one company going even so far as to undertake the manufacture of its machines on the premises.

Another motor company will show a new method of operating elevators directly by an electric motor without intermediate gearing. Such an elevator will be in operation in the building. A small electric railway will also be operated in the building and a fully equipped electric street car will be shown by one of the motor companies.

What will undoubtedly attract a large share of attention in this department will be the new pyromagnetic motor of Mr. Edison, which it is proposed to finish in time for the exhibition.

In the department of electric lighting several new incandescent and arc systems will be shown, among them one of low-resistance incandescent lamps in series. The arc lighting exhibits will include a dynamo of 100 arc lights capacity.

Various other applications of electricity will be shown, among which may be mentioned the interesting electric welding process of Prof. Elihu Thomson. The public will also, probably for the first time in this country, have an opportunity of seeing an ocean cable recorder at work, one of a new form lately designed having been specially constructed for this purpose.

Electricity as applied to ventilation will be exemplified in a number of ways by different exhibitors, and some novel applications in this field may be looked for.

The storage battery will also be represented, and the showing of electric conductors of all types will be quite large, underground systems being prominent.

The New York Electrical Society, under whose auspices the exhibition is being given, is arranging for an historical exhibit which will follow the growth of the electric art from its infancy up to the present time, and it requests contributions of apparatus and books to this collection, which promises to be a very interesting feature of the exhibition.

From the above it will be evident that the exhibition will be one well illustrative of current electrical development, and will give the public a good idea of the advances made within a few years. We might add that several foreign exhibits will also be shown.

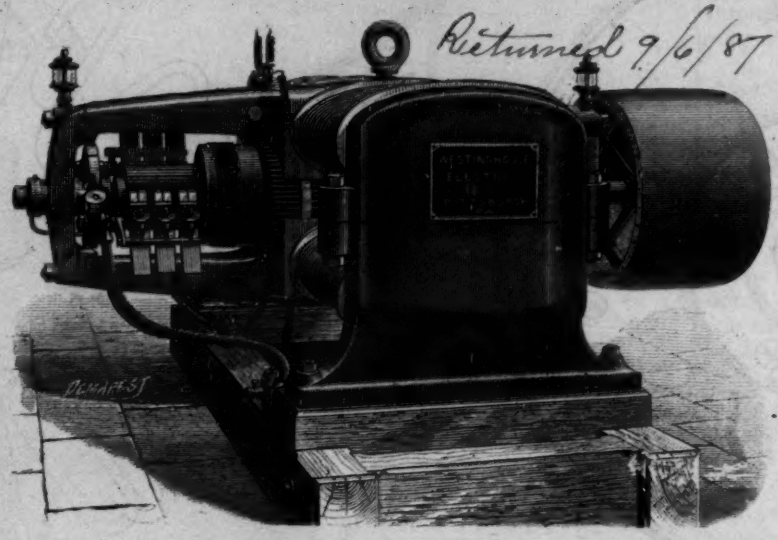


FIG. 6.—THE EXCITER.

The Westinghouse Alternating Current System.

We have from time to time given descriptions of various alternating systems of electrical distribution, and have on several occasions alluded to and described some of the apparatus used by the Westinghouse Company in this line of work. We are now, however, enabled to present to our readers the full details of the apparatus used in the Westinghouse system, which is rapidly gaining ground in this country.

The principle on which the alternating system is based is a well-known one, and consists in causing a reduction of potential from high to low, through the medium of the induction coil. By this means wires of small section, carrying high potential currents, can be carried to considerable distances, and at the distributing points, by means of converters, the high potential is reduced, so that it may be handled safely and introduced into dwellings and stores for lighting. Our illustration, Fig. 1, shows the plan of distribution in its elementary form. The dynamo *D* generates alternating currents which are led into the primary wire *P* of the converter *C*. The lamps *L* are connected to the secondary coil *S* of the converter, and receive the reduced potential.

The alternating machine which is employed in the Westinghouse system is shown in perspective in Fig. 2, and Fig. 3 shows the same in longitudinal section. This machine, the smallest size built by the Westinghouse Company, has a capacity of 650 lamps, 16 c. p., and is capable of generating a current of 32½ amperes at 1,000 volts potential. As will be seen, the armature revolves inside a ring or series of magnets of alternate polarity, so that the wires upon the armature have currents generated in them which alternate in direction between every magnet.

The armature, which is shown in section in Fig. 4. is built up of iron plates insulated from each other. The

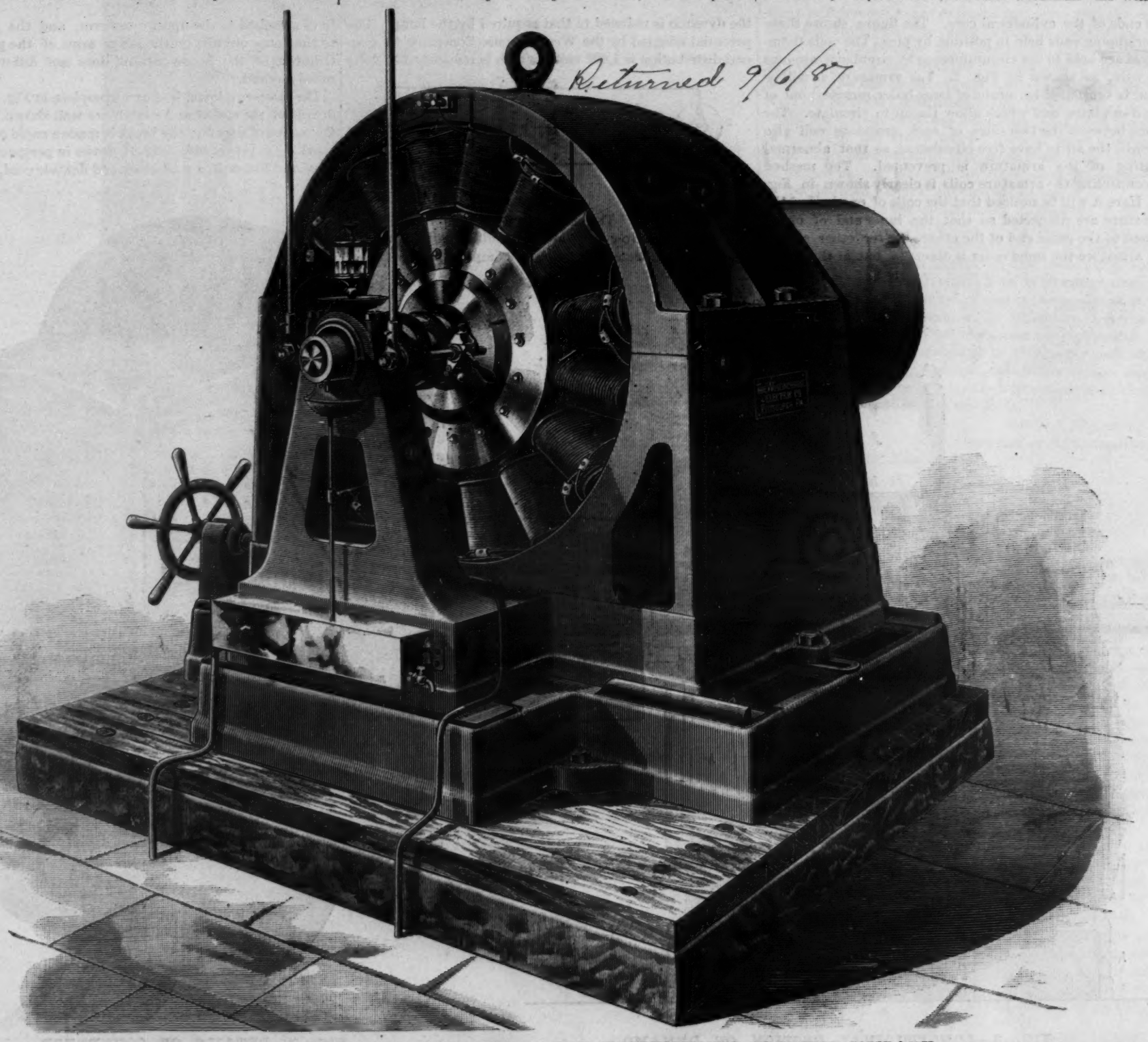


FIG. 2.—THE ALTERNATING MACHINE OF THE WESTINGHOUSE ELECTRIC COMPANY.

windings of the armature consist of flat coils, equal in number to the poles in the field, in this case 16, and their outer ends are bent at right angles, so as to lie flat against

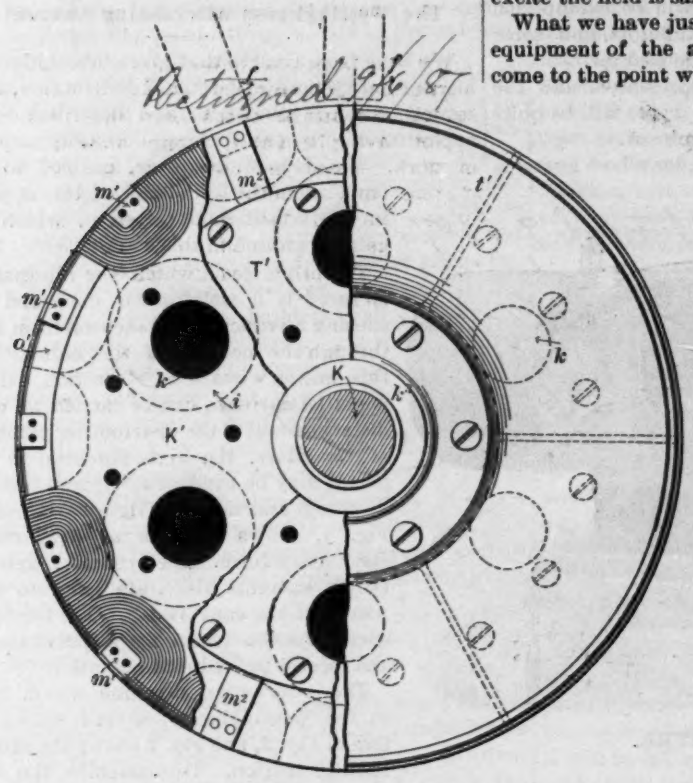


FIG. 4.—DETAILS OF ARMATURE.

the ends of the cylindrical core. The figure shows these overlapping ends held in position by pins. The coils themselves are held to the circumference by circular wrappings of wire, as shown in Fig. 3. The armature, as will be seen, is ventilated by means of large holes, punched out of the iron plates, and which allow the air to circulate. The space between the two sides of each armature coil also permits the air to have free circulation, so that abnormal heating of the armature is prevented. The method of connecting the armature coils is clearly shown in Fig. 5. Here it will be noticed that the coils of one-half of the armature are connected so that the inner end of one is joined to the outer end of the other, on the other side of the armature the same order is observed, but at the junction points between the two, both inner ends and both outer ends are connected and brought to the collector. The collector consists merely of two continuous copper rings upon which the brushes bear.

As the alterating current is not considered suitable for charging field magnets, the latter are excited by a separate machine giving a continuous current. The exciting machine employed for that purpose is shown in Fig. 6, and is of the consequent pole type. The power required to excite the field is said to be only 2 per cent. of the whole.

What we have just described is the essential generating equipment of the alternating central station. We now come to the point where the high potential generated by the dynamo is reduced to that required by the lamps. The potential adopted by the Westinghouse Company in general distribution is 1,000 volts, which is reduced to 50 volts

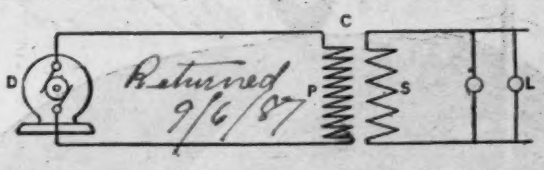


FIG. 1.

in the converters. The converter itself is shown in Fig. 7, and will be seen to consist of two insulated coils of wire, a primary and a secondary, almost completely surrounded by laminæ of iron insulated from each other, and held together by bolts at the corners. The capacity of these converters varies of course with their size, and the standard sizes built have a capacity respectively of 10, 20, 30 and 40 16 c. p. lights, although larger sizes than these are sometimes made. The weight of iron and copper in these converters is about 3 lbs. per light. They are fitted up with safety fuses on the primary and secondary terminals, so that any abnormal current would not damage the coils, merely cutting them out. These converters are enclosed in an iron case, and mounted upon iron poles, specially designed for the purpose, which also serve as lamp posts, as shown in Fig. 8. The primary coils are led to the

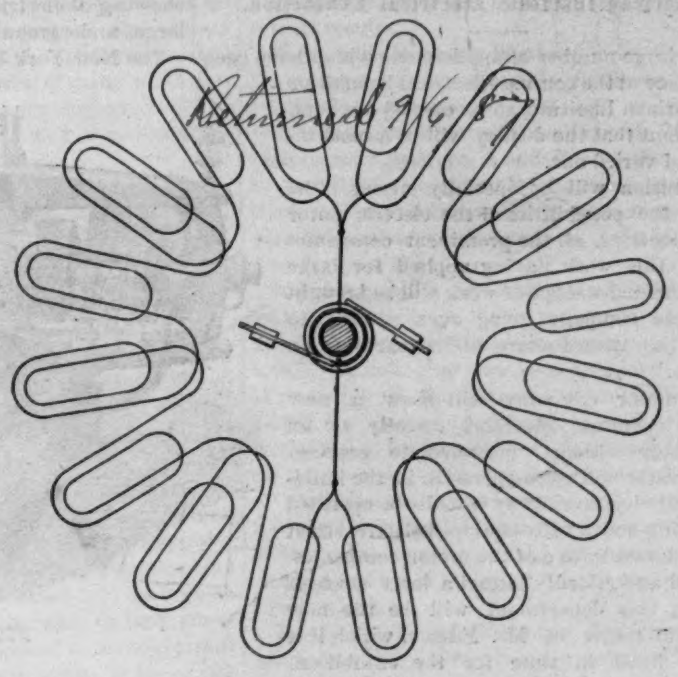


FIG. 5.—METHOD OF ARMATURE WINDING.

lines attached to the upper cross-arm, and the secondary to the house circuits on the lower arms of the pole. Distribution of the house-current does not differ from the usual method.

The lamp employed is shown complete in Fig. 9, and the details of the socket and switch are well shown in Fig. 10. By means of a spring, the break is made a rapid one, so that sparking is prevented. Fig. 11 shows in perspective, complete and in detail, a wall-block and flexible cord, by means of which the lamp can be moved about, and placed in any desired position.

The first installation employing an alternating current system in this country was operated at Great Barrington, Mass., by William Stanley, Jr., now the electrician of the Westinghouse Company, in the fall of 1885. He used

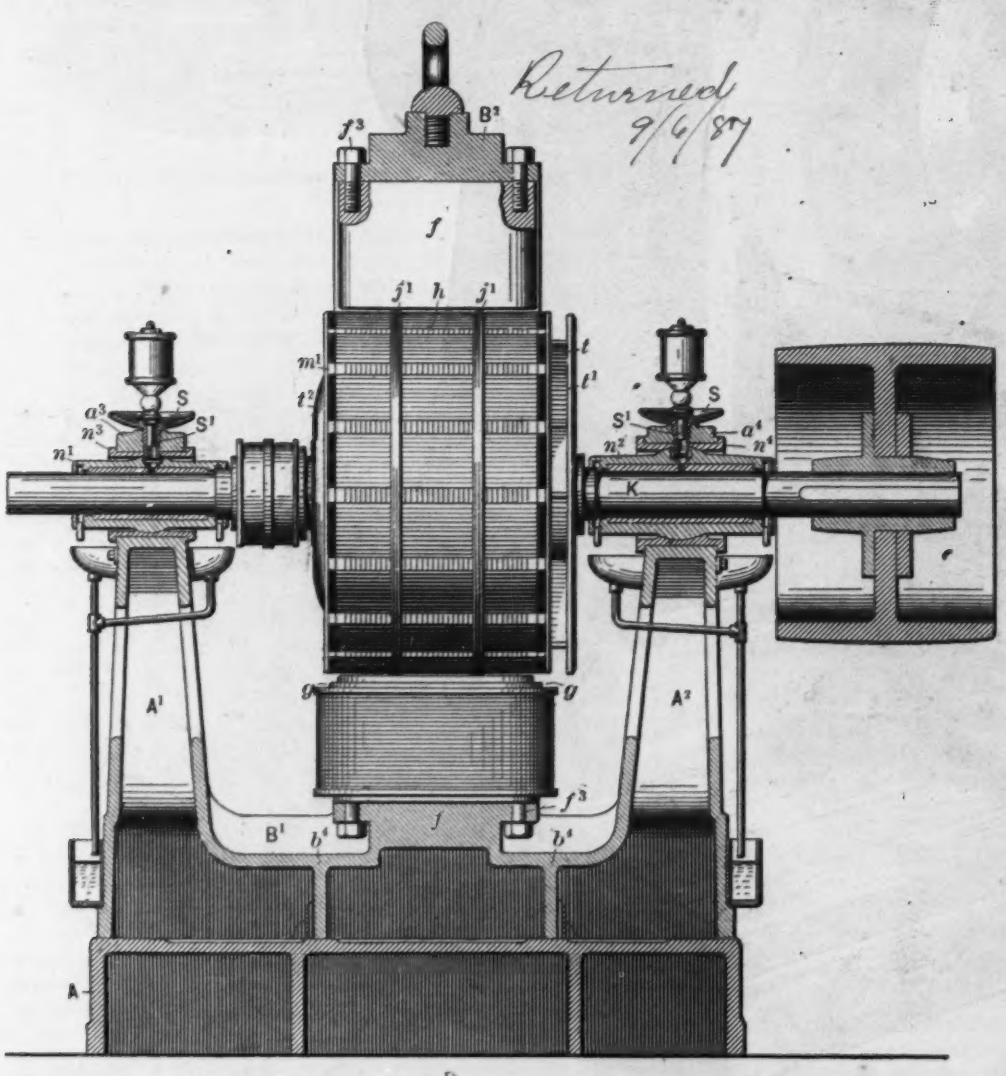


FIG. 3.—LONGITUDINAL SECTION OF DYNAMO.

FIG. 7.—DETAILS OF CONVERTER.

a Siemens-Alteneck alternating current dynamo with Stanley converters and the Stanley-Thompson lamp, by means of which he distributed lights to hotels and offices. Since that time the system has had a very rapid development, so that at the present day the Westinghouse Company has in operation 21 stations, and contracts for 47 additional ones, aggregating 134,000 lamps. The rapid development of this system is due to a number of men, among whom may be mentioned L. Gaulard, J. O. Gibbs, Wm. Stanley, Jr., Oliver E. Shallenberger, H. M. Byllesby, Philip Lange and Albert Schmid. Thus far, three sizes of machines have been built, and the following figures show the weights and capacities of each:

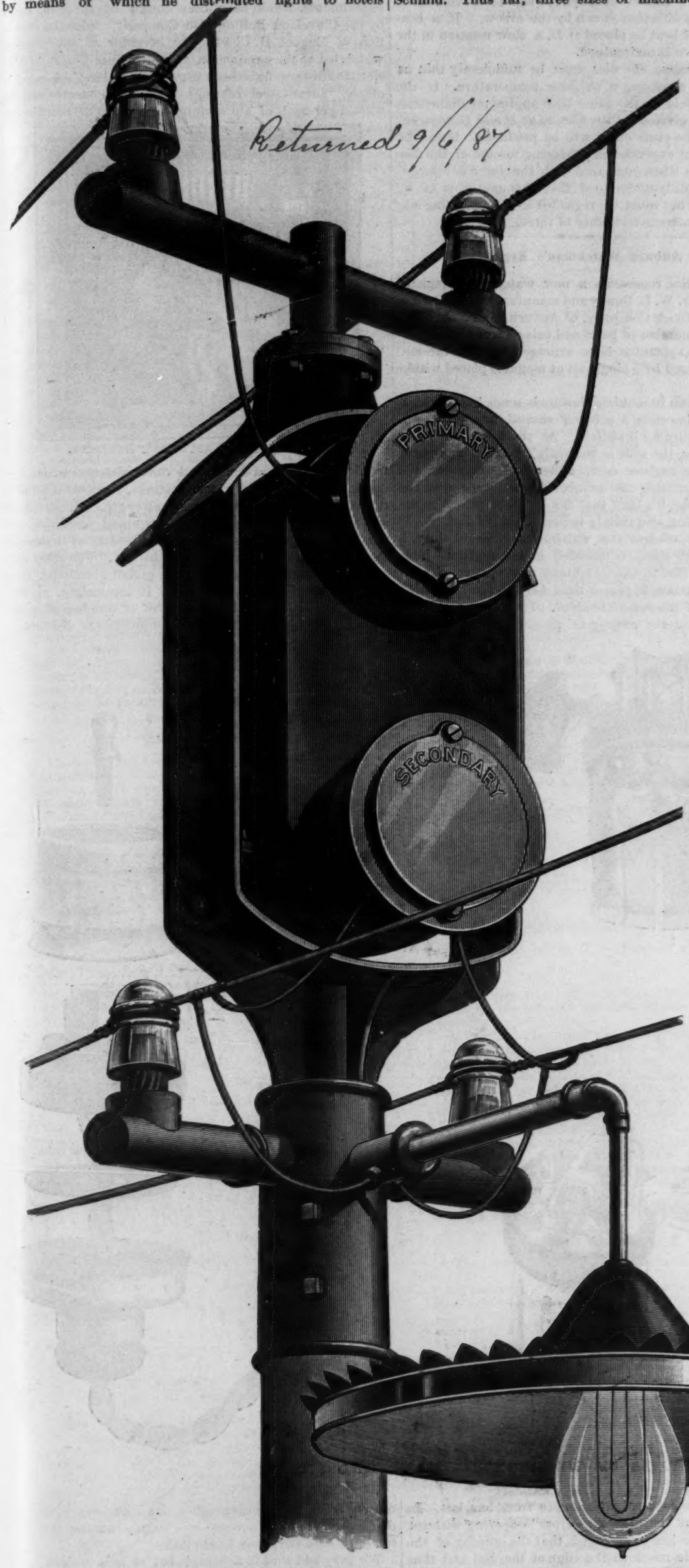


FIG. 8.—VIEW OF STREET POST WITH WESTINGHOUSE CONVERTER AND LAMP.

No.	16 c. p. lamps.	Weight.	Speed.	Amperes.
1.....	650	5,000	1,650	32½
2.....	1,300	7,500	1,650	65
3.....	2,600	13,500	1,175	130

The Report of the Committee on Insulation and Installation of the Electric Light Association.

To the Editor of The Electrical World:

SIR: I notice in your issue of the 20th inst., in the very full report of the sixth meeting of the National Electric Light Association, several statements concerning the report of the Committee on Insulation and Installation, to which, as chairman of the committee, I take exception.

Not having been able, through press of business engagements, to attend the meeting of the association, I desire through your columns to call attention to the following statements made concerning the above committee, viz.:

1st. The statment made by Mr. De Camp that he understood the committee did not wish to be responsible for their report.

I am unable to comprehend how anything in the report itself, or anything I may have said personally to Mr. De Camp, could be construed into an expression of unwillingness to assume the responsibility for anything to which I was willing to append my signature, and this I am sure can be said for the other members of the committee who signed the report.

What the committee did wish understood, as they stated in their report, was that they recognized the fact that some additions or alterations would probably be necessary in the code of tests proposed, when such code came to be subjected to actual trial.

2d. The statement made by the president, Col. Morrison, that "this committee, either all six, or one of its members, perhaps more, wrote to me asking, etc.," for an appropriation to meet expenses in carrying out tests. If Col. Morrison will refer to the letter in question he will find that it was written by the secretary of the committee, at the request of the committee itself, all of whom were present with the exception of Mr. Robinson.

The letter referred to contained the following phraseology in reference to the expenditures, viz.: that the committee be authorized "to expend a sum for express charges, stationery, incidentals and alterations, not to exceed $1,000; and, further, that the responsibility of accidental injury to the machines or instruments be assumed by the National Electric Light Association."

3d. The statement of the president, that from the date of receipt of the above letter "nothing more was heard from the committee until this paper, with quite a column of printed matter, was sent in yesterday or the day before to the National Electric Light Association."

As chairman of the committee, I notified Mr. F. A. Gilbert, chairman of the Executive Committee, some ten days or two weeks before the meeting of the association, that the Committee on Insulation and Installation would submit an incomplete report. This information does not appear to have been communicated to the president of the Association by the chairman of the Executive Committee.

In conclusion, permit me to express my regrets that the earnest effort of the committee to give to the association the best of what they had been able to accomplish should not have met with more courteous treatment than that of having their report laid on the table.

EDWIN J. HOUSTON,
Chairman of the Committee.

PHILADELPHIA, Aug. 22, 1887.

The Pyro-Magnetic Motor.

To the Editor of The Electrical World:

SIR: In connection with the ingenious pyro-magnetic generator of Mr. Edison, described in his paper read before the American Association for the Advancement of Science, and published in your last issue, it may be of interest to some of your readers to know that a pyro-electric motor, in principle substantially as described by Mr. Edison, was described by Professors E. J. Houston and Elihu Thomson as early as 1879 in Philadelphia. A description and illustration of this ingenious motor will be found in the *Journal of the Franklin Institute*, 1879, page 39. It consists of a thin disc of wrought iron placed between the poles of a U magnet, with its plane parallel to the lines of force and capable of rotation about its axis. On heating a certain part or parts of this disc it revolves about its axis.

The invention appears to be original with these gentlemen, and as they did not patent it, it should be considered as a generous gift on their part to the general public.

I call your attention to this early description, not only for the benefit of those who wish to further develop this invention, but also in order that the original inventors may receive due credit.

The publication of early references to an invention is loudly denounced by some and termed a "most exasperating thing" and "belittling an invention." Aside from the moral question that would be involved in intentionally keeping from the eyes of the public that which belongs to them and which they, therefore, have a right to know about, it seems to me that it should be considered as one's duty to the early inventors, particularly when they

have presented their invention to the public by not patenting it. Instead of denouncing the publication of early references, it should, it seems to me, be encouraged for the benefit of the public, for moral reasons, and as due justice to the inventors.

Mr. Edison certainly should have all due credit for his very ingenious pyro-magnetic generator, but Professors Houston and Thomson should also have due credit for their prior invention of the motor, which, as Mr. Edison

EXPERIMENTAL PYROMAGNETIC MOTOR.

states, was the first application of this principle, and which, as appears from his paper, he does not claim as his own.

CARL HERING.

PHILADELPHIA, Aug. 19, 1887.

The following is the article in question :

A CURIOUS THERMO-MAGNETIC MOTOR.

During investigations by the authors, concerning the increase in the coercitive force of steel by changes of temperature, the following curious thermo-magnetic motor was devised. This motor, though devoid of practical value will, no doubt, be of sufficient scientific interest to warrant a short description.

In the figure, a disc or ring of thin steel *D* is mounted on an axis, so as to be quite free to move. The edges of the wheel are placed opposite the poles *N* and *S* of a magnet. In this position the wheel of course becomes magnetized by induction.

If, now, any section of the wheel, as *H*, be sufficiently heated, the disc will move in the direction shown by the arrow. The cause of the motion is as follows: This section *H*, when heated, has its coercitive force thereby increased, and being less power fully magnetized by the induction of the pole *S* than the portion *C* immediately adjacent to it, the attraction exerted by the pole *S* on the latter portion is thereby sufficient to cause a movement of the disc in the direction shown by the arrow. If a constant source of heat be placed at *H*, a slow rotation in the direction shown is maintained.

To insure success, the disc must be sufficiently thin as to prevent its acquiring a uniform temperature. If the source of heat be at the same time applied at diametrically opposite portions of the disc, as at *H* and *D*, adjacent to the poles, the same effect will be produced. Since the amount of heat expended in producing motion of the disc is so enormous when compared with the force developed, it will be readily understood that this motor is of no value as such, but must be regarded as an interesting example of the interconvertibility of force.

The Auburn Watchman's Register.

Our illustration represents a new watchman's register designed by Mr. W. L. Bundy and manufactured by the Auburn Electric Clock Company, of Auburn, N. Y. In order to reduce the number of parts and bring them to the simplest form the apparatus is so arranged that all the stations are operated by a single set of magnets placed within the register.

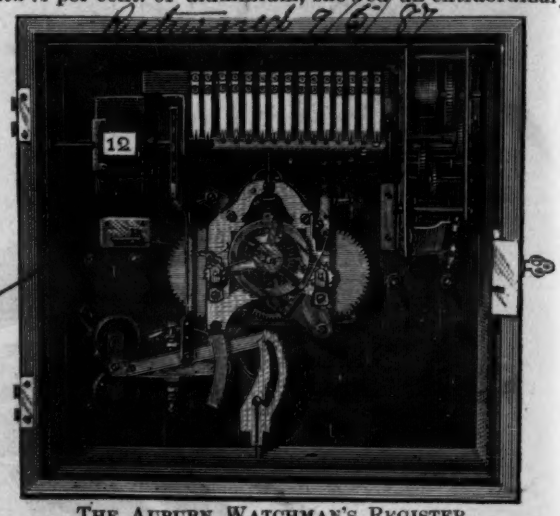
The watchman in making his rounds sends in a registering signal by inserting a peculiar shaped key in the station box and turning it therein. As the key is turned in the station box, the visit is instantly recorded on a paper dial inside the register case, either by puncturing the paper, or by printing the number in plain type upon the face of the same, the time that the key was turned in the station box being also plainly indicated on the dial.

In order to control the watchman while on duty, a superintendent's alarm is included in the register. This is so arranged that if the watchman does not register his visit at each station in proper time his absence is signaled at the house of the superintendent. The alarm also gives warning in case the watchman should be disabled from duty as in the case of interference from burglars. In order to prevent the watchman from tampering with the register, it is further so arranged that the opening of the door cuts a little notch in the edge of the dial and thus indicates the time at which the door was opened.

An important addition to the system is the fire alarm attachment. This can be operated either by the watchman on his rounds, or the alarm can be sent in automatically by means of thermostats. There is thus provided in the system complete protection. The paper dial in the register can be removed each day and filed away for reference.

Important Metallurgical Discovery.

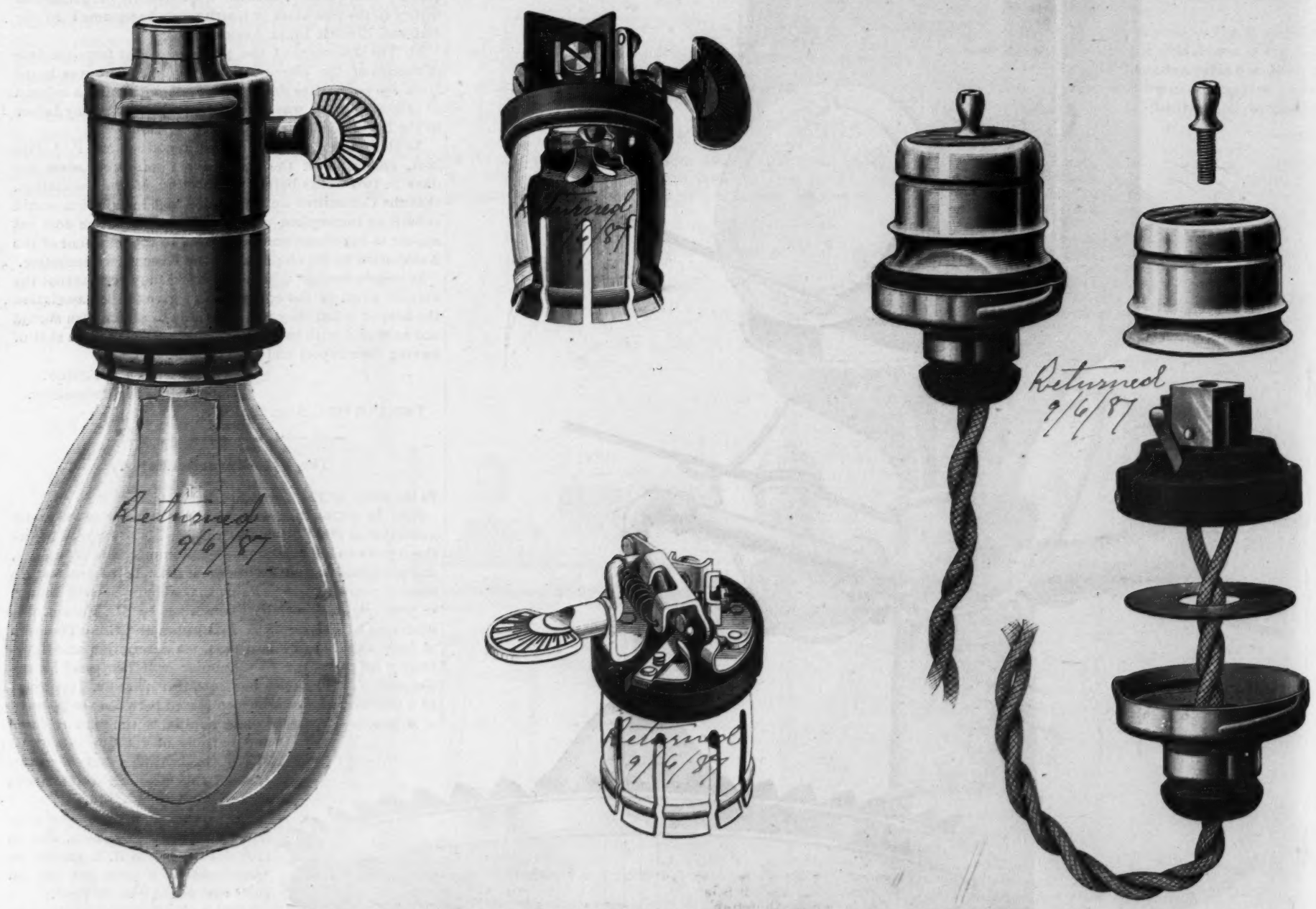
The Cleveland *Iron Trade Review* announces that some experiments, which have been conducted for some time by the Cleveland Rolling Mill Company, under the direction of Eugene H. Cowles, the inventor of the process which led to the production of aluminium bronze in the electric furnace, have been very successful in these experiments. Large steel castings, made with steel charged with .1 per cent. of aluminium, showed an extraordinary



THE AUBURN WATCHMAN'S REGISTER.

freedom from blow-holes and other defects, which are common with ordinary steel castings, and also showed a remarkable increase in tensile strength. Moreover, it was found that the addition of this small percentage of aluminium imparted to the steel the property of making a clean and perfect weld with wrought-iron. The alloy also greatly reduced the chilling of the metal, permitting it to enter the mold readily and to fill it completely, as was shown especially in the casting of a number of gear-wheels. Should further experience justify the deductions drawn from these experiments, the discovery is an exceedingly important one and will largely increase the uses to which cast steel may be applied.

We may add that in a sample bar of iron welded to a bar of Siemens-Martin basic steel with one-fifth of 1 per cent. of aluminium added, no line of weld can be seen, the characteristics of the steel appearing to extend far into the iron. Without the aluminium, a clearly defined weld is visible between iron and the same steel. The same firm show a forged bar of aluminium bronze, with 5 per cent. of aluminium; this broke at 36 tons per square inch of original section, with 60 per cent. elongation.



FIGS. 8, 9, 10, AND 11.—DETAILS OF WESTINGHOUSE LAMP AND SOCKET.

A Method of Comparing Galvanometer Coils.*

BY J. J. SKINNER, PH. D.

Maxwell, in his treatise on "Electricity and Magnetism," Art. 754, gives a method of finding the magnetic moment of a small coil by comparison with a standard coil. Bosscha, in 1854, in Pogg. Ann. XCIII., p. 392, gave a general method of comparing two coils; and Kohlrausch, in 1883, in Wied. Ann. XVIII., p. 513, where other references may also be found, gives quite an elaborate investigation. At a suggestion from Prof. S. W. Holman, of the Massachusetts Institute of Technology, I have tried a somewhat different method of comparison, and will here examine the theory of it and give the results of some experiments.

Maxwell's method is to suspend a magnet at the centre of the standard coil, and move the small coil parallel to itself along the common axis of the coil until the same current flowing in opposite directions in the two coils no longer deflects the magnet, the observation being made with the small coil successively on opposite sides of the standard coil, to eliminate uncertain errors.

In the method now to be described the two coils are rigidly fastened together, so as to be concentric and to have their assumed mean planes as nearly as possible coincident. (Concerning what is meant in strictness by "mean plane," see later.) The magnet needle is supported in the common axis of the coils at a measured distance from the assumed mean plane, and a resistance is introduced into the circuit of one of the coils, of such an amount as to leave the needle at rest when a divided current flows in opposite directions in the two coils. The resistances of the circuits of the two coils, being immediately measured, furnish data for comparing the constants of the coils. To eliminate errors in estimating what is supposed to be the position of the mean planes of the coils, and lack of symmetry of winding, a reversal of the rigidly connected coils is made, keeping the distance from the needle the same, or else the needle is supported first on one side of the coils and then on the other at equal distances.

I investigate the theory of the method as follows:

Let the mean radius, the number of turns of wire and the current flowing in the wire of the standard coil be denoted respectively by R, N and C, and the corresponding quantities for the second coil by r, n and c, and the common distance from the assumed mean plane of the coils to the magnet needle by e. I will for brevity speak of the standard coil as the coil R, and of the second coil as the coil r. The elements of the former are supposed to be accurately known, those of the latter to be determined.

If the sections of the coils are so small as to be negligible and the mean planes truly in coincidence, then if the currents be adjusted so as to leave the needle at rest we shall have the following equation between the forces exerted by the two coils on the needle, viz.:

$$\frac{2\pi R^2 NC}{(e^2+R^2)^{\frac{3}{2}}} = \frac{2\pi r^2 nc}{(e^2+r^2)^{\frac{3}{2}}}, \qquad (1)$$

If the radius r can be measured approximately, since a measurement of resistances of the coil circuits gives the ratio of c to C, equation (1) will give from one observation an approximate value of $\pi r^2 n$, the total area of the coil r. For accuracy, however, we must consider the effect of errors in estimating the position of the mean planes of the coils.

Assume as a point of reference from which to measure the distance e, say a pair of cross threads fixed with their intersection as nearly as may be in the common centre of the coils. Let the small distances along the common axis of the coils from this point of reference to the true mean planes of the coils R and r be respectively denoted by x and y, these distances being unknown, and positive or negative. Then instead of equation (1) we must write

$$\frac{2\pi R^2 NC}{[(e+x)^2+R^2]^{\frac{3}{2}}} = \frac{2\pi r^2 nc}{[(e+y)^2+r^2]^{\frac{3}{2}}}; \qquad (2)$$

which gives

$$\frac{C}{c} = \frac{r^2 n[(e+x)^2+R^2]^{\frac{3}{2}}}{R^2 N[(e+y)^2+r^2]^{\frac{3}{2}}}; \qquad (3)$$

which may be written in the form

$$\frac{C}{c} = \frac{r^2 n(e^2+R^2)^{\frac{3}{2}}\left\{1+\frac{2ex+x^2}{e^2+R^2}\right\}^{\frac{3}{2}}}{R^2 N(e^2+r^2)^{\frac{3}{2}}\left\{1+\frac{2ey+y^2}{e^2+r^2}\right\}^{\frac{3}{2}}}; \qquad (4)$$

and since x and y are small compared with R and r, this may be written with close approximation,

$$\frac{C}{c} = \frac{r^2 n(e^2+R^2)^{\frac{3}{2}}\left(1+\frac{3}{2}\cdot\frac{2ex+x^2}{e^2+R^2}+\frac{3}{8}\cdot\frac{(2ex+x^2)^2}{(e^2+R^2)^2}\right)}{R^2 N(e^2+r^2)^{\frac{3}{2}}\left(1+\frac{3(2ey+y^2)}{2(e^2+r^2)}+\frac{3}{8}\frac{(2ey+y^2)^2}{(e^2+r^2)^2}\right)} \qquad (5)$$

or by another approximation

$$\frac{C}{c} = \frac{r^2 n(e^2+R^2)^{\frac{3}{2}}}{R^2 N(e^2+r^2)}\times$$
$$\left(1+\frac{3}{2}\cdot\frac{2ex+x^2}{e^2+R^2}+\frac{3}{2}\cdot\frac{e^2x^2}{(e^2+R^2)^2}-\frac{3}{2}\cdot\frac{2ey+y^2}{e^2+r^2}\right.$$
$$\left.-\frac{3}{2}\cdot\frac{e^2y^2}{(e^2+r^2)^2}-\frac{9e^2xy}{(e^2+R^2)(e^2+r^2)}\right) \qquad (6)$$

Now if the coils, rigidly connected, be turned through an angle of 180°, and the distance from the point of reference to the needle be made exactly the same as before, and if C' and c' be the opposing currents required to produce in the new position a null effect on the needle, the quotient C'/c' will be the same as the right hand member of (6) except with opposite signs of x and y; that is, we shall have in the new position:

$$\frac{C'}{c'} = \frac{r^2 n(e^2+R^2)^{\frac{3}{2}}}{R^2 N(e^2+r^2)^{\frac{3}{2}}}\times$$
$$\left(1+\frac{3}{2}\cdot\frac{-2ex+x^2}{e^2+R^2}+\frac{3}{2}\cdot\frac{e^2x^2}{(e^2+R^2)}-\frac{3}{2}\cdot\frac{-2ey+y^2}{e^2+r^2}\right.$$
$$\left.-\frac{3}{2}\cdot\frac{e^2y^2}{(e^2+r^2)^2}-\frac{9e^2xy}{(e^2+R^2)(e^2+r^2)}\right) \qquad (7)$$

*Presented at the meeting of the American Association for the Advancement of Science, New York, August, 1887.

By adding (6) and (7) and dividing both members of the resulting equation by 2 we get

$$\frac{\frac{C}{c}+\frac{C'}{c'}}{2} = \frac{r^2 n(e^2+R^2)^{\frac{3}{2}}}{R^2 N(e^2+r^2)^{\frac{3}{2}}}\left\{1+\frac{3}{2}\cdot\frac{x^2}{e^2+R^2}+\frac{3}{2}\right.$$
$$\frac{e^2x^2}{(e^2+R^2)^2}-\frac{3}{2}\cdot\frac{y^2}{e^2+r^2}-\frac{3}{2}\cdot\frac{e^2y^2}{(e^2+r^2)^2}-$$
$$\left.\frac{9e^2xy}{(e^2+R^2)(e^2+r^2)}\right\}. \qquad (8)$$

Hence the total area of the coil r is approximately

$$\pi r^2 n = \frac{\frac{C}{c}+\frac{C'}{c'}}{2}\cdot\pi R^2 N\frac{(e^2+r^2)^{\frac{3}{2}}}{(e^2+R^2)^{\frac{3}{2}}}\left\{1-\frac{3}{2}\cdot\frac{x^2}{e^2+R^2}\right.$$
$$-\frac{3}{2}\cdot\frac{e^2x^2}{(e^2+R^2)^2}+\frac{3}{2}\cdot\frac{y^2}{e^2+r^2}+\frac{3}{2}\frac{e^2y^2}{(e^2+r^2)^2}$$
$$\left.+\frac{9e^2xy}{(e^2+R^2)(e^2+r^2)}\right\} \qquad (9)$$

By subtracting (7) from (6) we get

$$\frac{C}{c}-\frac{C'}{c'} = \frac{(r^2 n(e^2+R^2)^{\frac{3}{2}}}{R^2 N(e^2+r^2)^{\frac{3}{2}}}\left(\frac{6ex}{e^2+R^2}-\frac{6ey}{e^2+r^2}\right). \qquad (10)$$

In equation (9) the factor $\frac{\frac{C}{c}+\frac{C'}{c'}}{2}$ is the arithmetical mean of the values of the ratio of the currents in the coils in the two different positions. We must consider how great a difference of result is liable to arise from the factor represented by the large brace of equation (9) depending on x and y. We shall in any particular case usually have no difficulty in assigning, from our knowledge of the conditions, a limit below which we may be sure the values of x and y must lie. For instance, with well made coils and reasonable care in mounting, we might feel sure that x and y did not exceed one or two millimetres each. With assumed limits of x, y and e we may therefore by substitution determine a limit to the possible error of $\pi r^2 n$ which could arise by assuming x and y equal to zero in equation (9).

I will examine the separate terms of equation (9) that involve x and y. It is evident that for given values of x and y the terms $\frac{3}{2}\cdot\frac{x^2}{e^2+R^2}$ and $\frac{3}{2}\cdot\frac{y^2}{e^2+r^2}$ are largest when e is smallest; and to diminish the effect due to these terms we should therefore take e as large as we can consistently with other requirements. If $e=R$ the first becomes $\frac{3}{4}\frac{x^2}{R^2}$, and if $e=r$ the second becomes $\frac{3}{4}\frac{y^2}{r^2}$.

By differentiating the term $\frac{3}{2}\cdot\frac{e^2x^2}{(e^2+R^2)^2}$, we may show that for a given value of x this term has its maximum when $e=R$, the value of the term then being $\frac{3}{8}\frac{x^2}{R^2}$, which is one-half of the value of $\frac{3}{2}\cdot\frac{x^2}{e^2+R^2}$ for the same value of e.

Similarly making $e=r$ gives the maximum of $\frac{3e^2y^2}{2(e^2+r^2)^2}$, viz: $\frac{3}{8}\frac{y^2}{r^2}$.

Finally by differentiating the term $\frac{9e^2xy}{(e^2+R^2)(e^2+r^2)}$ we find that $e^2=Rr$ gives its maximum, which is $\frac{9xy}{(R+r)^2}$.

If e is very small or very large compared to R and r the terms of the brace in equation (9) that involve e in the numerator are very small.

It is evident by inspection of equation (9), disregarding the brace, that the larger the value of e the slighter will be the effect on the value of the right-hand member of equation (9) due to errors in estimating r.

Hence, other things being equal, the required total area of the coil r is best found by making e as large as may be. Of course it must be small enough to get the requisite magnetic action on the needle.

If we were simply trying to find n from a set of observations, it might appear that a smaller value of e would be preferable. For by solving equation (1) for n, and then differentiating with respect to e, we find

$$dn = \frac{C}{c}\frac{NR^2}{(R^2+e^2)^{\frac{3}{2}}}\left(1-\frac{2e^2}{r^2}\right)\left(1+\frac{e^2}{r^2}\right)^{\frac{1}{2}}dr. \qquad (11)$$

Thus when $e=\frac{r\sqrt{2}}{2}$ we have $dn=0$; hence, with this value of e, small errors in the estimate of r would be entirely negligible in their effect on the value of n. In case a coil is to be used for the determination of horizontal intensity by Kohlrausch's method we care more, however, to have the value of $\pi r^2 n$ accurately found than to know the separate values of r and n; and we have seen above that in using equation (9), errors in r have the least effect on $\pi r^2 n$ when e is as large as may be. Furthermore, if there is a great difference between R and r, any errors in measuring e would evidently from equation (9), disregarding the brace, alter the estimate of n more when e is small than when it is large.

On the whole, therefore, the best way to use the method is to make e large enough so that an approximate value of r may be taken in the right-hand member of equation (9) and the terms in x and y be disregarded. With proper care in mounting the coils there will be no difficulty in making x and y small enough for this.

If, however, the observations should show a large variation in the ratio of the currents in the two positions of the coils we may find the values of x and y very nearly as follows:

Make a pair of observations with a pretty large value of e, and with an approximate value of r calculate $r^2 n$ from equation (9), disregarding the brace. Then make a second pair of observations with a smaller value of e. The two different sets of values of $\frac{C}{c}$ and $\frac{C'}{c'}$ substituted successively in equation (10), with the approximate values of r and $r^2 n$, give two equations of the first degree in x and y, whose approximate values may thus be found, and used in equation (9) for finding a closer approximation to $r^2 n$.

We have next to consider the correction for the sections of the coils, when this correction is appreciable.

In a paper published in the first number of the *Technology Quarterly*, for September, 1887,* I gave an elementary demonstration of the factor by which the expression for the force due to a current in a coil of infinitely small section should be multiplied, to find the force when the section is rectangular and has a breadth $2b$ and depth $2d$, both small compared to the radius of the coil. (See also Maxwell, *Elect. and Mag. Art.*, 700, value of G_1). The factor is (*Tech. Quar.*, p. 64.),

$$1+\frac{d^2}{3}\left(\frac{1}{r^2}-\frac{15e^2}{2(r^2+e^2)^2}\right)+\frac{b^2(4e^2-r^2)}{2(r^2+e^2)^3}. \qquad (12)$$

Letting Q denote the value of this factor for the coil R, and q denote its value for the coil r, the members of equation (1) should be multiplied respectively by Q and q, and as Q and q are only "corrections" we can also use them as multipliers of the members of equation (2), without regarding any differences that might be made in Q and q by x and y. This would, therefore, amount to multiplying the right-hand member of equations (6), (7), (8) and (10) by $\frac{q}{Q}$, and the right-hand member of equation (9) by $\frac{Q}{q}$.

Applying this correction to equation (9) and taking e so large that x and y may be disregarded, we find the value of $\pi r^2 n$ with facility and sufficient accuracy.

The coils which I have compared experimentally were a standard galvanometer coil and the coil of a Weber "Bifilar Galvanometer" made by Edelmann. The former is marked "P" in the laboratory of the Institute of Technology, but for conformity to the formulas I will call it R. The other I call r.

The coil R consists of 327 turns of wire, of a total length of 53.250 centimetres; and the mean radius that has been taken for laboratory work, found from these data, is 25.917. The breadth and depth of the coil section are respectively 3.5 and 2.4.

I give all distances in centimetres.

The number of turns of wire on the coil r and its mean radius were unknown. It is wound in two parts on a hard rubber ring whose outside diameter is 11.405, and inside diameter 9.817. Each of the two parts is wound in a groove whose width is 0.285, the distance between the centres of these grooves being 1.042. The depth of the grooves as nearly as could be found without unwinding the coil was 0.696, determined by pushing a very fine needle down beside the wire in two places and measuring the projecting part of the needle and the total length of the needle. The grooves lacked 0.079 of being full. This makes the radial depth of the coil section 0.617 and the approximate mean radius of the coil $r=5.314$. The outer layer of wire in each groove consisted of 8 turns. After the completion of all my observations this coil was unwound, and a somewhat different value of r found, but I will give the computations first from the data here stated.

The galvanometer coil R was supported on its ordinary base, provided with leveling screws. The central post and needle of the galvanometer were removed, and a flat board with a hole in its centre was clamped to the coil. To some blocks on this board was clamped the small coil r, so as to be concentric with R, and the supposed mean planes were brought as near coincidence as external observation and measurement allowed. The hard rubber ring of the coil r had a small hole through one place between the grooves, and opposite to the hole was a clip for holding an end of wire. A fine thread, held at one end by the clip and passing at the other end of the diameter through a cork in the hole, served to define the apparent symmetrical plane of the coil r, and to use as reference in measuring e. A second thread perpendicular to the first (though not precisely in the same plane), fixed accurately the reference point at the common centre of the coils. The planes of the coils were brought into the magnetic meridian.

The chamber of the Weber "Bifilar Galvanometer" with its covers easily put on and off, and its long upper tube, was used for inclosing and supporting the needle, which was made of short bits of watch spring and attached to the lower end of a stem that carried a mirror, suspended by a long silk fibre. The needle was set at a distance west of the coils in their common axis, the adjustment into the axis being made by placing a T-square against the flat board that connected the two coils and using the cross threads as a guide. The support of the fibre had a vertical adjustment, and the leveling screws of the base gave a fine horizontal one. The lower edge of the needle was thin, and by temporarily supporting a small stick just below the axis of the coils I marked accurately the distance of the needle from the mean plane of the coils, as shown by the cross threads.

A divided current from a Daniell's cell (later two were used) was sent through the coils in opposite directions, and a resistance in the circuit of the coil R was adjusted until the effect of making and breaking the circuit was imperceptible on the needle as observed by scale and mirror. (In later experiments in which a total make or break of the circuit gave a troublesome throw of the needle, after finding the required resistance approximately the final adjustment was made by varying the resistance during the flow of the current until the needle vibrated equally about its normal point of rest.) By leads going to an Elliott bridge I then without disturbance of the coil circuits immediately measured their resistances, thus determining the relative currents in the two coils. Turning the rigidly connected coils through 180 degrees, and adjusting the needle in the axis at the same distance from the point of reference as before, which could be very accurately done by the leveling screws, similar observations were made.

Three sets of observations of the complete experiment were made in December, 1886, with the needle at different distances from the coils. The adjustable resistances then used in the circuit of the coil R could be varied to 0.1 ohm. In the second and third of these sets a short magnet was placed south of the needle to increase the sensitiveness. By timing a series of make and break impulses, or changes of resistance, to about the natural period of vibration of the needle the null point is very accurately fixed. The three sets of observations were made Dec. 18, 21 and 22 respectively. I will give them in order of distance of the

* See also THE ELECTRICAL WORLD of June 11, 1887.

needle from the cross thread, and will use C/c and C'/c' always in the same relation to the coils.

	Distance e.	RESISTANCES. Circuit R.	Circuit r.	$\frac{C}{c}$	$\frac{C'}{c'}$	$\frac{\frac{C}{c}+\frac{C'}{c'}}{2}$
Dec. 18	34.20	522.60	29.93	0.057264		
		534.33	29.98		0.056100	0.056682
Dec. 22	31.37	481.43	30.29	0.062915		
		490.99	30.25		0.061617	0.062266
Dec. 21	27.97	423.26	30.57	0.072216		
		433.64	30.63		0.070639	0.071427

Substituting successively in equation (10) the data and results of Dec. 18 and 21, and the value $r = 5.314$, I find $x = 0.141$ and $y = -0.028$. With these values the terms of equation (9) in x and y all become negligible, the last of them, which is the largest, being less than 0.00003.

With regard to the corrections to be applied for the sections of the coils, it is to be noted that the correction for coil r, which consists of two separated parts, requires a special modification. The breadth of the separate parts of this coil is small enough so that we may consider each part concentrated in the mean plane of the part. In my late paper in the *Technology Quarterly* I show by its equations (3) and (6) that the correction term for two single distinct concentric coils in the same plane, whose radii differ by $2d$, is three times as large as for a coil with its section flattened out equally from the mean to the depth of $2d$. The same principle clearly applies to the term of correction for two distinct coils of equal radius and common axis, but separated along the axis by a distance $2b$, as compared with one coil of breadth $2b$. (See the derivation of equation (7) of the paper referred to.) Hence in finding the correction due to the section of the coil r the term of the correction factor involving b must be multiplied by 3. Making this allowance in the case of coil r, and substituting in expression (12) the values $r = 5.214$, $d = 0.309$, $b = 0.521$, and again the corresponding values for the standard coil, $R = 25.917$, $d = 1.2$, and $b = 1.75$, together with the different values of e for the different days, the correction factors due to the sections of the two coils are found to be:

	q (coil r).	Q (coil R).	$\frac{Q}{q}$
Dec. 18	1.002256	1.001282	0.99903
Dec. 22	1.002450	1.001244	0.99880
Dec. 21	1.002748	1.001165	0.99842

I give below the values of $\pi r^2 n$ and n computed from equation (9), neglecting x and y, the first two columns being the values not allowing for section corrections, and the last two columns being got from the former by correcting for sections by multiplying respectively by the above values of $\frac{Q}{q}$.

	Uncorrected. $\pi r^2 n$	Uncorrected. n	Corrected. $\pi r^2 n$	Corrected. n
Dec. 18	20,523	231.34	20,503	231.11
Dec. 22	20,540	231.53	20,515	231.25
Dec. 21	20,515	231.24	20,482	230.88
Mean	20,526	231.37	20,500	231.08

The observations show a pretty close agreement among themselves.

A few months later, namely, in May last, I experimented with the same coils, but used very much smaller values of the distance e. The coils had in the mean time been separated, and had to be set up anew. I had also to use a different magnet needle and suspension. In this case, unfortunately, the needle was inclosed in a cubical box only about an inch square, surmounted by a tube, only one side of the box being removable, and it was therefore much more difficult to be sure of measuring e exactly than it was in the former case. The needle was made by fastening two bits of watch spring on the back of a mirror, and the measurement had to be made to the front of the mirror, and allowance made for its thickness. Also in one position the measurement had to be made from the point of reference to the end of a support that carried the box inclosing the needle, and then from that end back to the front of the mirror, so that on the whole this was a poor arrangement. I, however, give the results, as they illustrate some of the peculiarities of the method. The distance for May 26 is $e = r\frac{\sqrt{2}}{Q} = 3.77$, which, if measured with perfect accuracy, ought to be the best distance for determining n, as shown above from equation (11). The variable resistance employed could be changed by 0.01 ohm.

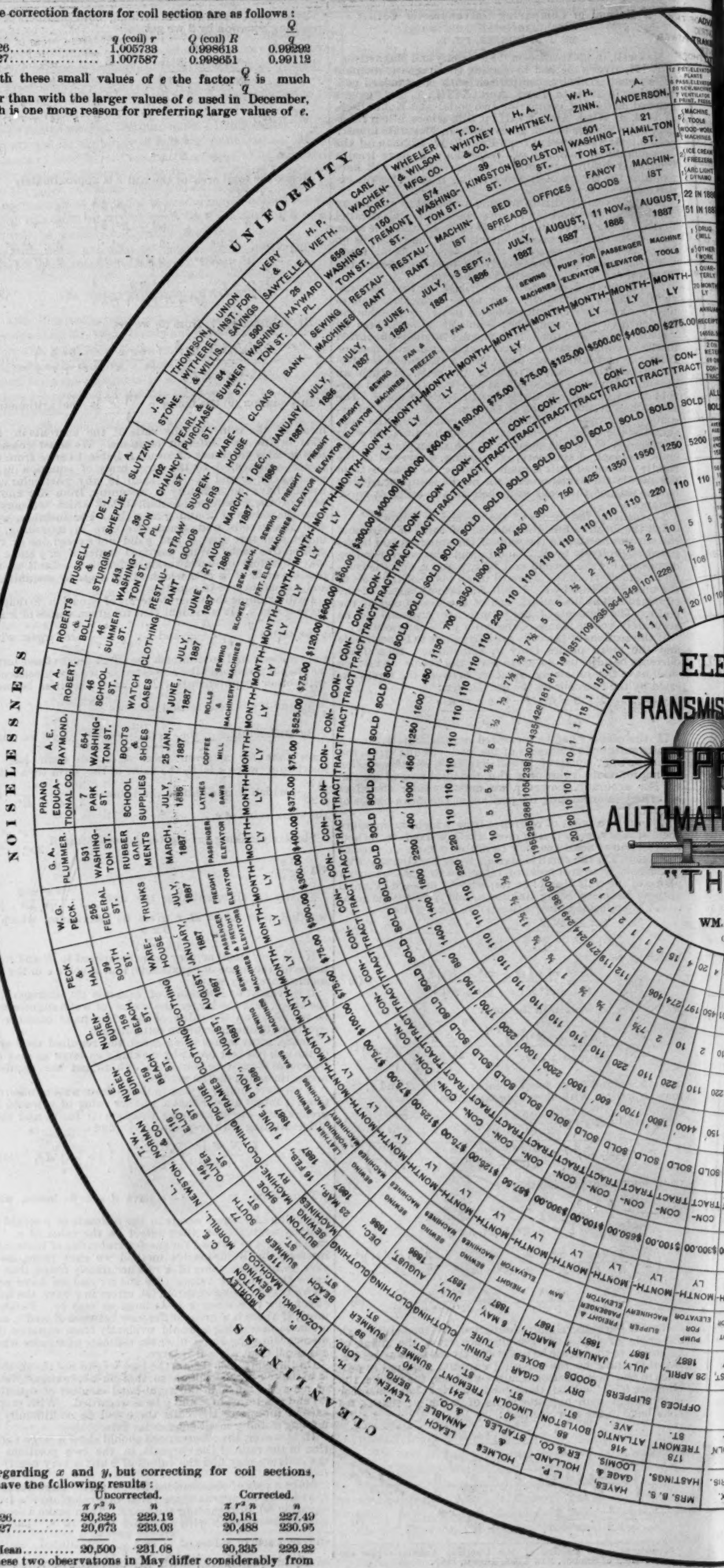
	Distance e.	RESISTANCES. Circuit R.	Circuit r.	$\frac{C}{c}$	$\frac{C'}{c'}$	$\frac{\frac{C}{c}+\frac{C'}{c'}}{2}$
May 26	3.77	19.232	35.613	1.85176		
		18.780	37.079		1.97439	1.91307
May 27	4.27	21.600	35.495	1.64329		
		19.886	35.484		1.78437	1.71383

The values of x and y from these results come out: $y = 0.235$, and $x = 5.74$, which cannot be correct. But we ought not to expect accuracy here, for when e is small and there is much difference between R and r, as in this case, a very slight error in e in equation (10) will have a large effect. Furthermore, the use of that equation for finding x and y assumes that e is measured exactly the same in the two positions of a set of observations, whereas if any part of the observed difference $\frac{C}{c} - \frac{C'}{c'}$ is due to a difference in the value of e in these positions the values of x and y deduced from the equation will not be accurate. It is not possible that y could have been greater than 0.2, or x greater than 0.3; and with these values the effect due to x in equation (9) would be much less than that due to y, which latter would not change the value of $\pi r^2 n$ by so much as 2 parts in a thousand. There were probably errors in e that would make very much greater changes than that.

The correction factors for coil section are as follows:

	q (coil) r	Q (coil) R	$\frac{Q}{q}$
May 26	1.005733	0.998618	0.99292
May 27	1.007587	0.998651	0.99112

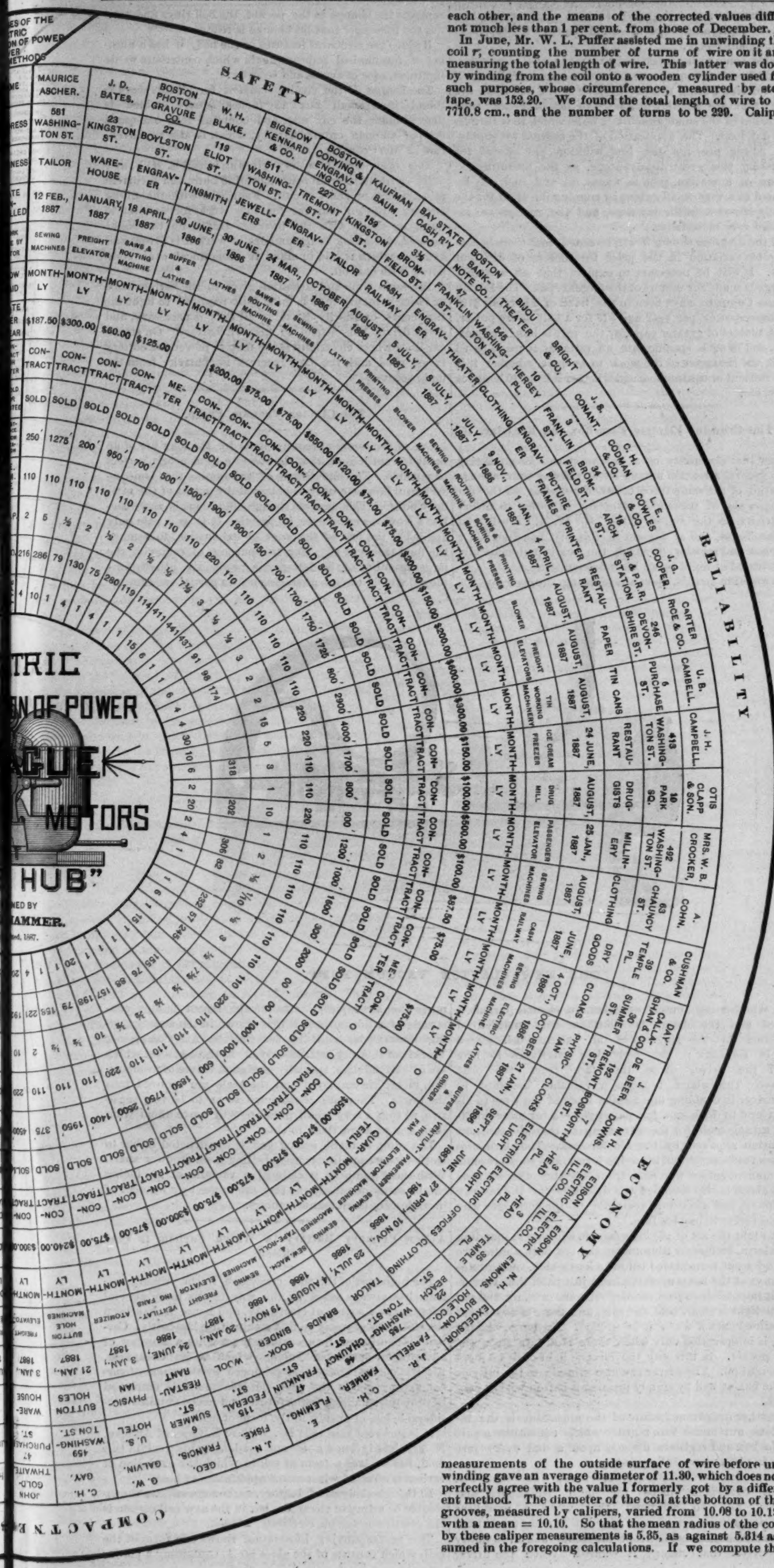
With these small values of e the factor $\frac{Q}{q}$ is much larger than with the larger values of e used in December, which is one more reason for preferring large values of e.



Disregarding x and y, but correcting for coil sections, we have the following results:

	Uncorrected. $\pi r^2 n$	Uncorrected. n	Corrected. $\pi r^2 n$	Corrected. n
May 26	20,326	229.12	20,181	227.49
May 27	20,673	233.03	20,488	230.95
Mean	20,500	231.08	20,335	229.22

These two observations in May differ considerably from



each other, and the means of the corrected values differ not much less than 1 per cent. from those of December.

In June, Mr. W. L. Puffer assisted me in unwinding the coil r, counting the number of turns of wire on it and measuring the total length of wire. This latter was done by winding from the coil onto a wooden cylinder used for such purposes, whose circumference, measured by steel tape, was 152.20. We found the total length of wire to be 7710.8 cm., and the number of turns to be 229. Caliper measurements of the outside surface of wire before unwinding gave an average diameter of 11.30, which does not perfectly agree with the value I formerly got by a different method. The diameter of the coil at the bottom of the grooves, measured by calipers, varied from 10.08 to 10.12, with a mean = 10.10. So that the mean radius of the coil by these caliper measurements is 5.35, as against 5.314 assumed in the foregoing calculations. If we compute the mean radius by dividing the total length of wire by the number of turns and by 2π it comes out 5.359.

A defect in the winding of the coil was found, viz: in one of the grooves, either to fill up or to cover defective insulation, which, however, did not appear, a thick strip of paper was wound in, so that one groove contained only 101¼ turns of wire, while the other one had 127¾. This would have more or less effect on the mean radius of the coil of wire. I did not note the exact position of the strip of paper, but Mr. Puffer tells me that his remembrance is that it was near the top of the groove. On the whole, we may assume 5.35 as probably pretty near the true value of the mean radius from direct measurements.

The effect of the inequality in the two parts of the coil, in the formulas used, should be examined. Assuming that the point of reference taken in my observations was exactly in the mean plane between the two grooves, what would be the distance from this point of reference to the true mean plane of the whole coil? This question leads to another, viz., what is meant by the true mean plane of a coil when the section is a pretty wide one? Writers seem to have assumed that it is a plane such that at equal distances on each side of it, in the axis of the coil, a needle will be equally deflected. This assumption is probably correct enough in most cases, but it can be shown that a plane so determined by observations with the needle at a given distance may not be exactly the same as one determined with the needle at a different distance, if there is much inequality in the winding of the coil.

It is easy to make out the formula by which can be calculated, for a given distance of the needle, the position of such a plane between two parallel and co-axial coils of equal radius and unequal numbers of turns in infinitely small sections.

If $2b$ denote the distance between the coils, if m and n denote the respective numbers of turns of wire on the coils, e the distance of the needle from the required plane and x the distance to this plane from the half-way point between the centres of the coils, the wire of the two coils carrying equal currents, I find, when there is not too much difference between m and n, the approximate formula:

$$x = \frac{n-m}{3\,(n+m)} \cdot \frac{\dfrac{1}{[r^2+(e-b)^2]^{\frac{3}{2}}} - \dfrac{1}{[r^2+(e+b)^2]^{\frac{3}{2}}}}{\dfrac{e+b}{[r^2+(e+b)^2]^{\frac{5}{2}}} - \dfrac{e-b}{[r^2+(e-b)^2]^{\frac{5}{2}}}}$$

and only when b is small compared to r this reduces, for all values of e, approximately to

$$x = \frac{b\,(n-m)}{n+m},$$

the required plane lying nearer to the coil having the greater of number of turns of wire.

If we assume each part of the coil that I have called r to be of infinitely small section, the two parts being separated by the distance between the centres of the separate grooves, viz., 1.042, and having a mean radius = 5.35, one of the parts having 101¼ turns and the other 127¾ turns, I find for large values of the distance of the needle, the position of such a plane is about 0.06 cm. from the middle position between the grooves. As the value of y that I found above for the December observations was less than 0.03, I conclude that whatever error was then made in judging of the mean plane of coil r happened to be in a direction to diminish the effect of the inequality of winding.

I will now present a comparison of the values, corrected for sections, given by all the foregoing observations, taking successively 5.314 and 5.35 as the radius of the coil r.

	Dist. e.	$\pi r^2 n$ $r = 5.314$	$\pi r^2 n$ $r = 5.35$	n $r = 5.314$	n $r = 5.35$
Dec. 18,	34.20	20,503	20,513	231.11	228.12
Dec. 22,	31.37	20,515	20,527	231.25	228.28
Dec. 21,	27.97	20,482	20,497	230.88	227.94
Mean of Dec.		20,500	20,512	231.08	228.11
May 26,	3.77	20,181	20,455	227.49	227.47
May 27,	4.27	20,488	20,743	230.95	230.68
Mean of May		20,335	20,599	229.22	229.07

Thus, with $r = 5.35$ the December mean of $\pi r^2 n$ is 20,512, and the May mean 20,599. The value calculated with $n = 229$ is 20,592.

It will be seen from this table that the December values of $\pi r^2 n$ (owing to the large values of e) are very little changed by the change in r from 5.314 to 5.35, although the corresponding estimates of n are changed nearly 1½ per cent. On the contrary the May values of $\pi r^2 n$ (owing to the small values of e) are changed more than 1 per cent. by the same change in r, while the corresponding values of n are changed but very slightly; that for May 26 almost none at all. These results agree with the remarks made above in discussing the formula, viz., that large values of e are best for determining $\pi r^2 n$; and values of $e = \frac{r\sqrt{2}}{2}$ if obtainable with perfect accuracy, best for determining n. In my experiments, however, the value of r is so small, and that of R so large, that this value of e is too small to be really favorable to accuracy in n, as the difference between the results of May 26 and 27 shows, although the mean of the two days happens to make n almost exactly 229, as found by counting, and therefore if $r = 5.35$, make the area $\pi r^2 n$ very nearly what we shall have to conclude to be correct.

I do not know to what to lay the difference, something less than half of 1 per cent., between the mean of the December observations on $\pi r^2 n$ and the value computed with $n = 229$ and $r = 5.35$. No change in the value of r that we can reasonably make would alter the mean of the December values of $\pi r^2 n$ very much. A small part of the difference may possibly be due to unknown error in the assumed value of the radius of the coil R; but probably this error is small, as a change of nearly half of one per cent. in the radius R would be needed to account for the whole difference.

The great difference between R and r in the coils used is unfavorable to accuracy of result. The close agreement of the December observations among themselves, however, indicates that the method is a good one under good conditions. The coil r was not selected for its merits in illustrating the method, but because its total area was required in finding the horizontal intensity by Kohlrausch's method.

Distribution of Power by Sprague Motors in Boston.

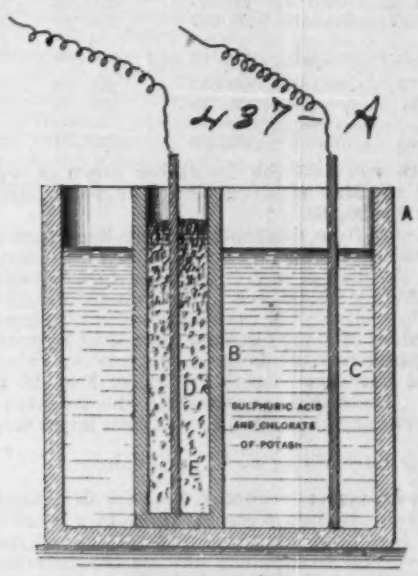
Bostonians are very much given to speaking of their city as the "Hub of the Universe," and Mr. W. J. Hammer has, in the diagram on pages 130 and 131 appropriated the idea for the Sprague motor in regard to the transmission of power from the Edison station in that city. The diagram, whatever its origin, shows that motor as the hub of widespread industry, and in the shape which it has been given, it possesses considerable advantages in the classification of the information regarding the motors individually and collectively.

The diagram is represented as a large wheel. The tire

THE CROWDUS CAR-FARE BOX.

shows the advantages of the electric transmission of power over steam, gas, water and other methods. Between two spokes radiating from the upper side of the hub is placed a column of titles or heads under which the data is arranged, ranging from the name of the party employing the motor down to the type of the motor. The adjoining column to the left gives collective data, averages, etc., of the motors, as a whole. The names are alphabetically arranged, so that by running the finger around the circle, any particular customer may be found, and by running the finger down the column any data relative to that customer can be instantly referred to.

The arrangement of the data in this shape enables one to secure not only individual but also collective data, such as comparisons between motors doing the same class of work or motors of the same horse-power, etc. It also enables one to secure collective data readily; for instance, by running the finger down to the title "Horse-Power" and adding up the horse-power given in the circle, one can see instantly the amount of power transmitted from the Boston Edison station. In a similar manner, by adding up the circle under the head "Rate per Year," one may see the income from motors. In the same manner,



THE CASE CARBON-CONSUMING BATTERY.

the character of the work done by the motors, the number sold and rented, the number on contract and meter basis, whether the power is paid for quarterly or monthly, may be readily determined; in fact, this means enables one to get individual, collective and comparative data of all the motors represented on this sheet at a glance.

The Edison Electric Illuminating Company, of Boston, has at its station, No. 3 Head place, one of the most important plants for the electric transmission of power in this country, or in fact in the world.

It is interesting to learn that while this sheet has been prepared at a very recent date, the number of motors appearing therein has already been considerably augmented. It is also interesting to note that up to a recent date one inspector was all that was required to take charge of all these motors. At the present time he has an assistant. This gives evidence of the simplicity of the working of electric motors and the small amount of wear and tear, and the slight amount of attention required to keep them running efficiently.

It has come to be considered that no station of any considerable size or importance can operate successfully without running during the twenty-four hours, and there are many that are running at a positive loss in the day time by reason of the small amount of light which they furnish as a day load. The application of the current for supplying power presents the best solution yet offered for obviating this great disadvantage, as the operating expenses of a station, such as wages, oil and fuel are increased to a very small extent by running the plant for the supply of power in the day time, and the receipts are increased very materially.

In the diagram shown it will be noted that there is considerable variation in the price for motors of different sizes. It will be necessary to explain that no arbitrary charge is made for motors of the larger types. The Boston Edison Company have been in the habit of charging $125 per horse-power per year and $75 for a half horse-power. With motors of greater capacity the rate is less in proportion, and in each specific case an estimate is made based upon the character of the work to be done, whether it is intermittent or continuous, and whether it is for 10 hours or more, etc.

The Crowdus Electric Fare-Box and Register.

Now that electricity as a motive power is attracting such general attention among street railway men, the application of the same force to other purposes on the car becomes also of particular interest. In order to utilize electricity to the fullest extent, Mr. W. A. Crowdus, of Dallas, Texas, and at present in this city, has designed a fare-box and register, in which the box is automatically illuminated at night by an incandescent lamp.

In addition to this, upon a fare being dropped into the box, whether coin, check or ticket, an electric circuit is closed and the driver is simultaneously notified of the fact by the ringing of an alarm bell placed within the box; the bell then continues to ring until the driver drops the fare from the first pocket. This alarm becomes a valuable assistant to the driver in enabling him to give more of his time to his team and to look out for passengers—a far more profitable arrangement for the car company than the constant attention required by the old fare-box. The alarm also makes futile any fraud in paying a fare, and thus prevents the many disputes that arise from this and other sources. This alarm is also intended as a detective for the railway company, and a constant reminder to the passenger who would forget to pay his fare.

At night the act of paying a fare, in addition to sounding the alarm, brilliantly illuminates the box with a minature incandescent lamp placed behind a lens which concentrates the rays of the lamp upon the fares just paid, thus rendering it impossible to pass counterfeit coins or sham tickets.

The light is clear, neat and safe, and there is no current consumed except when it is needed. The lamp, like the bell, is in operation only when there is a fare upon the first pocket. In this way the electric light costs no more than coal oil. The driver can also illuminate the interior of the box at will by simply pressing a button within easy reach.

Another important feature of the apparatus is the ingenious automatic fare register which constitutes a part of the box and registers directly upon a dial every fare paid in plain view of the passengers.

There is also a change receptacle in the box in a convenient place for both passengers and driver and so arranged that when a passenger deposits a coin for change the bell strikes two distinct strokes, distinguishable from the other alarm, to notify the driver that change is wanted. When the driver replaces the change in the pocket, the bell rings and notifies the passenger that his change is ready.

Besides the electrical features of the box, it has a number of mechanical improvements which contribute to its lightness, ease of access and security.

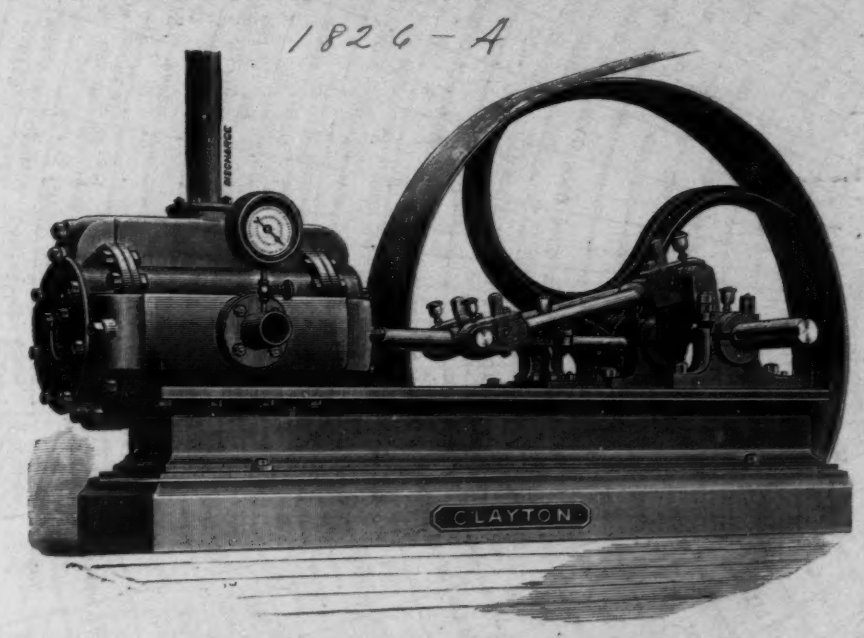
The source of the electric current for all this work is found in a small box 10 inches square, which is placed under the car seat, and contains four one-quart cells of an open circuit battery, which is also the invention of Mr. Crowdus.

This open circuit battery gives an initial E. M. F. at 2 volts—with an internal resistance of .5 ohm, and a current at 4 amperes on short circuit. Four cells with one filling furnish sufficient current for this work for at least 15 days, on roads with the heaviest traffic, up to longer periods, according to the amount of work it is given, and at a cost which is said to make it economical even compared with coal oil.

The same time and attention given to the battery once or twice a month that is now daily required to light the fare-boxes ordinarily in use, is all that is necessary, and every driver can attend to his own battery. On street-car lines where electricity is the motive power the battery is not used and the box receives its current from the main source.

The Clayton Vacuum Pump.

One of the essential requirements for the long life of an incandescent lamp is that the vacuum be as nearly perfect as possible. The high degree of exhaustion that is necessary can, however, only be obtained by means of the mercury pump. This process though efficacious is nevertheless a slow one and hence in practice it is as a rule only applied at the end of the work of exhaustion, to remove the final traces of air. For the purpose of removing the larger quantity of the latter, air pumps are usually employed which, though producing only a partial vacuum, remove the air rapidly. One of the recent pumps constructed for this purpose is that shown in the accompanying illustration, built by the Clayton Air Compressor Works, of this city and Brooklyn. In these pumps, which are of various sizes, specially designed valves of composition metal are employed and the seats are screwed into the heads. They are constructed so as to be very sensitive, so that a very small pressure will move them from their seat or allow them to close.



THE NEW CLAYTON VACUUM PUMP.

The pump is double acting and is constructed either to work with steam direct or by belting from a power shaft. With these pumps it is claimed a vacuum of 29½ inches can be easily obtained, and they are in use by a number of incandescent lamp manufacturers.

A New Primary Battery in Which Carbon is Consumed.

The high cost of the zinc consumed in the primary battery has always stood in the way of its more general adoption as a source of electricity, and hence it has been the endeavor of many to find a substitute less costly. Carbon in its different forms evidently presents a number of advantages, principal among which is its cheapness. Electric currents have been produced by the union of carbon and oxygen in the past, but the methods employed have required a high temperature and hence entailed considerable loss of energy in the form of heat.

It is to avoid this that Mr. Willard E. Case, of Auburn, N. Y., already known to our readers by his work in this field, has devised a form of cell in which the oxidation of carbon is effected without the application of heat.

In the usual styles of battery, carbon constitutes the insoluble or negative electrode, but in the new cell carbon is the positive or soluble electrode.

The accompanying illustration shows one form of the cell, which consists of the glass jar *A*, containing a porous

cup *B*, in which is placed a conducting body of hard carbon *D*, such as coke. The negative electrode is a sheet of platinum *C*.

In the porous cup is placed a quantity of carbon *E*, in comminuted form, previously moistened with sulphuric acid. In the outer vessel *A* is placed sulphuric acid. A cell thus arranged will give substantially no current, inasmuch as both elements resist the action of the acid. To the acid, however, chlorate of potash is gradually added in small quantities. The result of the reaction of the sulphuric acid and chlorate of potash is the formation (among other things) of peroxide of chlorine ClO_2, which is a yellowish-red gas, and which permeates the liquid, gradually turning it to a red color. For practical purposes it is sufficient to cease adding chlorate of potash when the acid turns a distinct red. A reaction between the carbon and the peroxide of chlorine will, however, begin as soon as the peroxide permeates the porous cell and reaches the carbon, and if the addition of chlorate be suspended, this reaction will continue until the acid loses its red hue, when probably the chemical affinities between the peroxide present and the carbon are satisfied. More chlorate may then be added.

Peroxide of chlorine is a very unstable oxygen compound, decomposing under the action of sunlight and exploding at a temperature of 140° Fahrenheit. The cell is shown uncovered in the illustration, but in practice, according to Mr. Case, it is better to cover it, so as to prevent escape of gas. So, also, it is better to make the outer vessel of opaque material, and particularly of dark colored glass, so as to cut off the light-rays while allowing inspection of the liquid. The peroxide of chlorine formed in the cell apparently decomposes into chlorine and oxygen. The oxygen attacks the carbon, producing apparently carbonic acid. The other products of the reaction of the chlorate of potash and sulphuric acid are seemingly inert in the cell. A certain amount of polarization occurs, which may be reduced by agitating the liquid or otherwise mechanically removing the gas, or by chemical means.

The presence of the porous cup is not essential to the operation of the cell, but it is used because it retards the access of the peroxide of chlorine to the carbon, and so diminishes the rapidity of attack upon the carbon. So, also, the reduction of the carbon to comminuted form is not material, but preferable in order to allow of ready permeation of the mass by the peroxide. Mr. Case has successfully used cells in which the carbon was in solid form placed directly in the electrolyte. According to Mr. Case actual experiments have shown that the E. M. F. of the cell is 1.25 volts.

The Heisler Long-Distance Incandescent System in the East.

On Monday of this week the towns of Fishkill and Matteawan, on the Hudson, were lighted for the first time by the Heisler long distance system. The combined circuits are over 18 miles in length, the distance to the farthest lamp being four miles from the station. A single dynamo capable of maintaining 160 thirty c. p. lamps is driven by water-power at 820 revolutions.

Of the lamps in use there are 44 of 30 c. p.; 138 of 20 c. p., and 1 of 45 c. p., making in all 183 lamps. The lamps are all in series, and require a current of about 5 ampères. The circuit consists of a No. 8 B. & S. wire. This is the first installation in the East undertaken by the Heisler Electric Light Company, of St. Louis, and the results obtained to date are very satisfactory.

NEW YORK NOTES.

OFFICE OF THE ELECTRICAL WORLD,
NEW YORK, Aug. 29, 1887.

I mentioned the other day that Mr. Jay Gould's house is to be lighted by electricity, and that it would have some Julien cells. I learn now that the plant will comprise 280 Julien cells, and that these will be charged from the street circuit. There is a report, by the way, that the cars on the Elevated Road are to be lit from Julien cells. This is somewhat premature, but I understand that a start is being made with one car.

Mr. C. W. Matchett is superintending the new departure of the New York and New Jersey Telephone Company in the manufacture of insulated wires and cables, with a complete outfit, at Robertson's Lead Incasing Works, 131 Water street, Brooklyn. The plant comprises tanks, compound boilers, braiders, and all the other apparatus necessary for first-class work.

Mr. H. A. Stout, representing the American Company, was in Detroit recently and came away with rich spoils in the shape of a contract for a 50 arc light plant, for the large dry goods store of Newcomb, Endicott & Co. The dynamo will be run by a 50 h. p. New York Safety Steam Power Company's engine.

The American Company has just issued two very neat and effective circulars as to its operations and as to what its customers think of the apparatus. The list of what is practically the first year's business of the company shows 7,169 lights at a list price of $864,360. The testimonials speak for themselves. The number of gas companies among the purchasers of American apparatus is quite striking.

The Edison Company has been making a tremendous push uptown, with its "subway" work, and, speaking at a venture, must now have 30 or 40 miles of tube down in its new district to be served from the station on Sixth avenue and Twenty-sixth street. Large gangs of men are busy all day long, and the various stages of the work are taken in hand and completed in the most systematic and practical manner possible. I could not help being struck not only with the compactness of the tube system but with the cleanliness of the work. Here we have the city agog because of the horrible smells encountered from the vile gas mains uncovered in the different streets, and the Health department has to invent a new disinfectant to meet the emergency; and, on the other hand, these electric services may be down for fifty years, and yet when they are taken up the ground they lie in will be just as sweet and fresh as that from which the violets sprang, above Ophelia's "fair and unpolluted corse." Poetry may be quizzed, but it is excusable when one thinks of the wonderful change thus effected, and I am glad to think that electricity is not only the introducer of better sanitary and æsthetic conditions in our homes, but will do not a little to keep our streets from taint and filth. I speak from recent personal experience when I say that in some of the streets where the gas mains are exposed the stench is simply unbearable.

I had the pleasure of a chat recently with Mr. E. Cunningham, superintendent of the electric light department of the Brooklyn Bridge, and heard him rehearse all the troubles that have been experienced with the wires on that structure. At first the wires were run through plain iron pipes, but soon became grounded, and so the pipes were discarded. Then the wires were put in wooden ducts against the iron work, but the ducts became wet and so failed to insulate. Even in good weather the damp, salt sea air saturated the wood, and thus the current was conducted into the iron of the bridge. This arrangement was in turn abandoned, and now glass insulators, extending some distance away from the iron, are in use. In spite of all the precautions the wires running up the arc lamp poles would get grounded, but Mr. Cunningham's attention happened to be called to the "P & B." paints and electrical compounds made by the Standard Paint Company of this city. He thereupon covered all the joints and exposed wires with this paint, and now, he says, finds no trouble from grounds. He has tried the paint also with good results on the wires conducted under the engine room floor. This experience is certainly an interesting and instructive one.

We are promised a new crusade against the bucket shops. This is what the New York *Times* says about it:

"Finally the bucket shops are going to be wiped out. Or, at least, that's what some enterprising members of the New York Stock Exchange are promising. District Attorney Martine and Inspector Byrnes are enlisted in the cause. A grand jury is to do some indicting. The gambling law is to be applied. The information which is most sedulously guarded by the parties chief in charge will have plenty of interest for all Wall street. The bucket shop has been a thorn in the Stock Exchange side these many years, but never as now has this sharp competition been felt. At present, except when some big deal is to be worked or something akin to a panic hits the financial world, the bucket shops have more patronage than the public gives to the aristocratic Stock Exchange. Outspoken members of the Stock Exchange admit this unhesitatingly, and clear headed brokers have declared emphatically that the Stock Exchange cannot hope to regain old-fashioned prosperity so long as the bucket shops are left to thrive undisturbed. Other men with ideas have not put so much stress on this particular danger to the Stock Exchange interests, but no broker will agree to any proposition that suggests that these shops are without power or competition for speculative patronage. But nobody has appeared yet openly with any cure for the bucket shop nuisance, and the bucket shop keepers have grown rich just in proportion as members of the Stock Exchange have grown poor. Were bucket shops really wiped out for good this morning, Stock Exchange seats would pop up from $20,000 to $30,000 in their market value before the day was over, and precious few brokers would care to sell at the advance. It isn't merely in this city that the bucket shops are flourishing. They are established all over the country. Scarcely any city is too small to be without one or more. The watering places have all had their quota this summer. The Western Union Telegraph Company draws a great big revenue for private wires leased exclusively to bucketshop proprietors, who gobble the New York Stock Exchange's quotations to "trade" on. Efforts abundant have been tried whereby to break up these lively competitors. Russell Sage and Jay Gould have promised to cut off all telegraphic service from the bucket shops if the Stock Exchange will but give to the Gould-Sage ticker company the exclusive right to gather and peddle the Stock Exchange quotations. Of course a great, big, shame-faced deal was behind this proposition, but for a time it seemed to have a fair likelihood of acceptance, and honest men trembled over the prospect of having placed in such hands an absolute control of the stock market's thermometer. For reasons that can hardly be recited without provoking some rather bitter discussions the scheme fell through. The bucket shops still have their private wires. And the average Stock Exchange man has gritted his teeth desperately over the ancient saw whose philosophic assurance is that what can't be cured must be endured. On a boat bound for Long Branch some days ago a knot of interested brokers discussed this depressing dilemma and got into an ardent discussion of ways and means whereby to effect a change. The result was that finally a plan was hit upon and a campaign mapped out. It has been talked about in whispers among brokers of high position, and big brokerage houses have chipped in generously to raise a fund wherewith to press a fight vigorously. It isn't a small amount of money that has been raised; it is more than hundreds of dollars. The Police Department is now collecting evidence against all the New York bucket shops, and the District Attorney's office is depended upon to secure a speedy indictment just as soon as the proof is in hand. One shop is to be presented first, and it won't be the richest and most influential; but what the courts do in its case is to be a precedent whereon to proceed against all the others. Or, at least, that's the way that the brokers who have the campaign in charge are talking."

Being in conversation with Mr. Alfred Dolge, of the Dolgeville, N. Y., Felt Manufacturing Company, last week, I was very much interested to learn that he was using the Edison light for his mill, and that he is supplying the town adjacent with nearly 1,200 incandescent lamps, on very satisfactory terms. Mr. Dolge commented on the erroneous impression abroad that the electric light costs too much to be within the reach of ordinary people. As he says, that is quite a mistake. He is furnishing ten lamps at $2.50 per month, and large users get the light at 30 cents per lamp a month; and while he is supplying light at this rate, he himself practically gets his own light free. Mr. Dolge speaks very enthusiastically of the electric light, and is quick to admit that he could not get along without it. Mr. Dolge, by the way, has his factory located in a part of the State where nature has been unusually liberal of water supply, and hence runs his lighting and manufacturing plant by water power. He manufactures felt on an extensive scale as an insulating material for a great variety of electrical purposes. This felt can be used not only in the dynamo for insulating the fields and intersecting parts, but can be employed for electrical instruments of all kinds as a means of avoiding dampness. It is made in all sizes and thicknesses and styles, and appears eminently adapted to new uses. Mr. Dolge has his offices at 132 East 13th street.

Mr. Charles Wann, representing the Union Fire Alarm Company, of 145 Broadway, is feeling very well pleased over his success in securing a big contract from the city of Altoona, Pa. The struggle of the competing companies was, it is said, never so warm before, and the parties had to go through a very severe ordeal, tests being made in the council chambers of the city government as to the efficiency of the system, and the excellence of the various parts. Altoona is nothing if not mechanical, and Mr. Wann is therefore inclined to look upon the endorsement given to his system as extremely significant and valuable. The Union Company will put in 24 non-interference boxes, 6 indicators, 6 gongs, 6 inking and printing recorders, 2 tower bell strikers, 8 miles of pole, and 8 miles of wire. This it will be seen constitutes a large plant, and it is plain that the installation will be of the utmost service.

The following, from the *Mail and Express* of August 29, is interesting if nothing more: "An interesting degree of anxiety is manifested by the Board of Electrical Control to anticipate the probable action of the Gas Commission when it holds its meeting on Thursday next. As is well known, there is a certain amount of antagonism between the Mayor and his colleagues in the board. By virtue of his office, Mr. Hewitt is also a member of the Gas Commission. In that body the members are all in harmony with the Mayor in his endeavor to get the best lights for the city at the lowest rates. At its last session it received bids for lighting certain streets and public places. The bids were not so low as they might be, and there is a suspicion that a certain gentleman, whose name has been frequently mentioned in connection with Rollin M. Squire's services to the public, got in some fine work for a company in which he is interested. It is said that, with the exception of the Mayor, the Board of Electrical Control favors this gentleman's cause, and that his company will have no trouble in getting all the favors possible. Mayor Hewitt will not signify when the contracts will be awarded, and it seems to be pretty certain that all the bids now in stand a chance of being thrown out and new ones advertised for. Then it is expected that the Mayor will insist upon all companies having an equal chance."

Chas. A. Schieren & Co. report a very brisk demand for the product of the American Leather Link Belt Company, whose sole agents they are. They say that this belt runs truer because it can be made endless, without the lap as in flat belts, and that it contains no cement, and, therefore, is practically the only leather belt that can be made waterproof. It is so constructed, too, that there can be no vacuum or cushion under it on the pulley, and being very firm and durable it can be run at high speed, in narrower widths than ordinary belting. The links are made in all sizes as to thickness or width. Two of the 7-inch "Electric" belts have gone in the fine plant of Mr. E. H. Johnson at Greenwich, Conn. With regard to their "Electric" belting, the firm report orders from the American Electric Illuminating Company, of Augusta, Ga.; the Thomson-Houston Company, Quincy, Ill.; the Jarvis Engineering Company, Boston, and the Colorado Electric Company, 10 double.

W. T. H.

NEW ENGLAND NOTES.

BRANCH OFFICE OF THE ELECTRICAL WORLD,
BOSTON, Aug. 29, 1887.

The Milford, Mass., Electric Light Company is said to be increasing the lighting capacity of its station owing to the demand in that town for additional arc lights.

It is reported that the Hartford (Conn.) Electric Light and Power Company have found it necessary to put in additional engines and dynamos in order to keep up with orders for electric lights and power.

A contract has just been closed between the Edison Electric & Illuminating Company, of Boston, and R. M. Huston, the New England agent of the Heine Water Tube Safety Steel Boiler Company, for several boilers to be put in Station No. 2 of the former company (Bowker street, Boston) just as soon as the foundations and flooring of the boiler room are finished. It is stated that the steam plant will be about 2,000 horse-power.

The New England Wiring and Construction Company, of Boston, Mass., has its force busily at work at the factory of the Bates Manufacturing Company, Boston, and Messrs. S. S. Pierce & Company's new building, Boston, wiring for the Edison system of incandescent lighting. The former building will be wired for 300 lights and the latter for about 1,200. Messrs. Paine & Francis, of Boston, the New England agents of the Edison United Manufacturing Company of New York furnish the lights.

The Northampton (Mass.) Electric Light Company is said to be doing a prosperous business. It has just closed a contract with the authorities of the city named to light the City Hall. The building will be lighted with arc and incandescent lights. It was only a few weeks ago that the company increased the equipment of its arc-light department, and now it has replaced a 150-light incandescent machine with a 400 lighter.

The Boston & Albany Railroad Company is equipping additional cars with incandescent lighting apparatus, using as before the Julien storage battery. Messrs. Blodgett Brothers & Company (Boston) have in hand the fitting up of the cars with wires and fixtures for the lamps; in fact, this firm has attended to all the electrical work for the B. & A. Railroad, both at its stations and on its cars.

Mr. P. H. Alexander, the New England agent of the Sawyer-Man Electric Company, reports that inquiry regarding his company's system has become very general, particularly so in the

New England States; and that the economy of the Sawyer-Man lamp is becoming better known every day. Mr. Alexander further says, that the plant installed by his company at Bar Harbor, Me.,—1,400 incandescent lights—is giving great satisfaction. Bar Harbor has no gas, and when electricity was introduced it was welcomed and appreciated as an illuminant, and it has been adopted by most of the hotel people and "cottagers" in that city and vicinity. This company is installing a 100 incandescent light plant for Mr. S. Wright, at Pownal, Vt.

The Thomson-Houston Electric Company reports the following orders it has filled in the New England States since July 1, 1887: Thomaston, Conn., Electric Light Company, 30 arcs and 500 incandescents; Southbridge, Mass., Electric Company, 100 arcs, and Dover, Mass., Electric Company, 50 arcs and 400 incandescents. This company reports also having made increases in arc and incandescent systems as follows: Newburyport, Mass., Electric Light and Power Company, 30 arcs; Milford, Mass., Electric Light and Power Company, 50 arcs; Keene, N. H., Gas Light Company, 20 arcs; Essex Electric Light and Power Company at Haverhill, Mass., 50 arcs; Woonsocket, R. I., Electric Machine and Power Company, 50 arcs and 600 incandescents; Middlesex Electric Light Company, at Lowell, Mass., 25 arcs; Lewiston & Auburn Electric Light Company, at Auburn, Me., 50 arcs; Hartford, Conn., Electric Light Company, 300 incandescents; Springfield, Mass., Electric Light Company, 400 incandescents, and the New Haven, Conn., Electric Light Company, 300 incandescents.

A corporation has just organized in Kittery, Me., under the name of the Steel-Copper Wire Company, with a capital stock of $500,000. Mr. Edwin S. Thayer, of Sharon, Mass., is reported as being the president of the new enterprise.

The Noll Wiring Company, with Mr. Frederick Noll as manager, and Mr. Chas. A. Dunham as superintendent, has become established in commodious quarters on Head Place, off 35 Boylston street, Boston.

Bell Telephone ranges from 207½ to 205, closing at 206. It is supposed that the Supreme Court decision will be rendered about Oct. 11.

Erie telephone shareholders are to meet in New York Sept. 2 to act upon a proposition from the American Bell Telephone Company for a perpetual contract covering the Northwest territory, and to act upon the matter of conveying the property in the Northwest territory to the Northwestern Telephone Exchange Company. The next dividend of the Erie Company will be 75c., payable Nov. 15.

The Boston *Daily Globe* of Aug. 27 contained the following: Lord Acoustic Telephone stock has advanced to 126 and closes at that figure. The company is on a firm, substantial basis and its business prospects were never better. Sub companies will be organized in New York and Philadelphia this fall, which will greatly increase its revenue.

The Wheeler Reflector Company, of Boston, is becoming generally and favorably known among the electric light companies throughout this country and abroad, and its product—for use in connection with both arc and incandescent lights—is already in large demand in the electric lighting field. This company has filled orders recently for its reflectors to the following local electric light companies, viz.: Jamestown, N. Y., Electric Light Company; Pawtucket, R. I., Electric Light Company; and Boone, Iowa, Electric Light Company.

Another system of electric time has made its appearance in this section. The new enterprise comes before the notice of the public under the name of the Electric Standard Time Company. Its officers are, viz.: Mr. George U. Crocker, treasurer, and Mr. J. N. George, superintendent. The offices of the company are at No. 79 Milk street, Boston.

The Emerson Power Scale Company will move its manufacturing establishment to Florence, Mass., at once. It is said that Messrs. D. G. Littlechild, president of the Florence Machine Company; Oscar N. Kyle, treasurer, and E. A. Thissell, of Lowell, have taken the stock of the company and have bought out the invention from the inventor, Mr. James Emerson.

A company has been formed to develop the mica mines near Middletown, Conn., under the name of the Connecticut Mining Company. Dr. Eugene Frankfort, a French mineralogist, in a report over fifty years ago, said: "The mica occurs here in large foliated layers, that is, in the feldspar quarries, and crystals, some half a foot in thickness, and is often of a pitch-black color." The market price for mica now is such that if the mine is a success a large profit will be made from the product. Eight farms have been bought, which are said to be valuable for this purpose, and for copper pyrites, silver, zinc, bismuth, tourmalines, red and green, apatelite, rutile, uranite and other minerals.

The Gamewell Fire Alarm Company, of Boston and New York, has a force now at work installing its system as follows: At Marlboro, Mass., 15 boxes, one bell striking machine, one whistle machine, six small gongs and five indicators. At Palmer, Mass., three boxes, one bell striking machine and one gong. At Chicopee, Mass., four boxes and one bell striking machine. At Natick, Mass., the finishing touches are being put to the installation of three boxes, one bell striking machine and two large gongs. The company is extending and enlarging the system at South Framingham, Mass., so as to include in same circuit the neighboring town of Framingham. The additional equipment will consist of ten boxes, three bell striking machines and one large gong. The Gamewell Company will soon commence work on another installation of its system at Plymouth, Mass. This will require eleven boxes, one bell striking machine, two small gongs and one indicator.

The committees of the Boston Electric Club, pursuant to a call from the president, met in joint session at the headquarters of the club, No. 66 Boylston street, on Thursday evening, Aug. 25.

President Frank Ridlon, Treasurer H. H. Eustis, Secretary A. V. Garratt and a majority of the members of the various committees were present. The affairs of the club were discussed at length, and a number of resolutions, looking towards the advancement of the organization, were passed and adopted. The reports of the treasurer and secretary showed that the progress of the club since the date of its organization had been rapid and highly satisfactory, and that the outlook for its continued prosperity was decidedly encouraging.

The list of members already enrolled contains—at this date—about one hundred names and includes a majority of the most prominent electricians and electric light people in Boston. Many other gentlemen have forwarded by mail applications for membership, and it was noted that the post-mark on several communications thus received indicated that the electrical fraternity in all parts of New England is beginning to take proper interest in the objects and aims of the Boston Electric Club. It is earnestly desired by the present members that every city and town in Massachusetts, Rhode Island, Connecticut, Vermont, New Hampshire and Maine will contribute to the influence and prosperity of the Club by adding their quota to the membership list. At the meeting referred to, the following distinguished gentlemen were elected honorary members, viz.: Prof. A. E. Dolbear, of Boston, Prof. Chas. R. Cross, of Boston, Prof. J. H. Holman, of Boston, Prof. Elihu Thomson, of Lynn, Mass., Prof. John Trowbridge, of Cambridge, Mass., Prof. A. Graham Bell, of Washington. It was decided upon at the same meeting that the club's "housewarming" shall occur sometime in September. Just before the adjournment, the president introduced Mr. C. K. Giles, of Chicago.

Advices from Washington, D. C., report that Mr. Thomas J. Mayall, of Boston, was in that city for a few days last week, for the purpose of taking out additional patents upon devices relating to his systems of elevated and street railway transportation. Mr. Mayall has now over 40 patents for inventions connected with his pneumatic, electric and cable railway systems, and when they are put into practical operation he expects to revolutionize the street railways of our large cities. Mr. Mayall's most important invention, perhaps, is his pneumatic system for the transportation of mail and express matter. With his devices he expects to attain a speed of four miles a minute between the large cities, reducing the time for sending the mails from New York and Chicago to less than four hours. W. I. B.

PHILADELPHIA NOTES.

PHILADELPHIA, Aug. 29, 1887.

A dispatch of Aug. 21, from Burlington, N. J., conveys the following sad information: Maude Carter, the ten-year-old daughter of Frank S. Carter, inventor and manufacturer of electrical appliances, member of the firm of Partrick & Carter, was drowned in the Delaware River about 8 o'clock this morning. Owing to the prominence of the family and the high esteem in which they are held, the sad episode has caused a shock to the entire community. The body was discovered by one of the crew of Mr. C. Ross Grubb's yacht "Codorus," which lay at anchor near by. She was seen by him to run down to the water's edge and begin to play along the gravel beach in front of her father's residence. His attention was called elsewhere, but soon after he saw her floating in the water not ten feet from the shore. The young girl was immediately removed to the house and Dr. Van Rensselaer, who lives next door to the Carter mansion, summoned, but life was found to be extinct. So quickly was the sad tragedy enacted that not ten minutes intervened from the time she left the house in play until she was carried back a corpse. Mr. Carter owns a steam launch and almost daily took his two little daughters, Maude and Florence, out for a boat ride. They were perfectly familiar with the water and could handle the tiller of the little craft like veteran sailors. On account of this experience they were allowed greater freedom about the river than is usually granted to children of their age. The child is supposed to have had a sudden fainting fit.

The coming Constitutional Centennial Celebration, which will occur on Sept. 15, 16 and 17, promises to be one of the most elaborate and successful affairs in the city's history. The arrangements already made and projected indicate that it will be a complete success in every particular. During the three days there will be a grand military and naval display, in which over 50,000 regular and State troops have already signified their intention of taking part, the government has ordered a naval display, in which all of the available war ships will participate, and the various volunteer firemen's associations will turn out to the number of probably 3,000 or more, bringing with them all, or nearly all, of the old and venerable relics in the shape of hand and steam fire engines, hose carts, paraphernalia, etc. Then there will be a civic display and parade, which will outshine anything of the kind ever known in the country.

The monster civic and industrial procession will not be one of numbers, but of illustration and demonstration, bearing on the wonderful advancement in the arts and sciences since the time of the signing of the Federal Constitution. As an illustration of the magnitude of the civic parade, I may mention the fact that there will be in line an old Washington hand press side by side with one of the most modern fast perfecting presses, which will print and distribute papers at the highest possible rate of speed along the route; an old-time locomotive as compared with those magnificent iron monsters of to-day; a log cabin, with a complete frame house, now in course of construction by the Carpenter's and Joiner's Association, directly behind it. The Girard Point Storage Company will give an illustration of the past and present means of handling grain in an elevator of modern type; the government will display the old and new styles of cannon and other means of warfare, and so on through the entire list of the mechanical arts and sciences. All of these displays will be made upon "floats" especially constructed for the occasion, and it would seem that there is no limit to the size and capacity of these carriages, when it is known that the mining companies of the State will have in the line a complete coal breaker in full operation.

But there is one element somewhat lacking as yet, and this, too, apparently from want of interest and leisure. I called upon Colonel A. Loudon Snowden, Marshal of the Civil and Industrial Department, yesterday, to learn what arrangements had been made for an electric display, and to what extent the wonderful advancement in electrical science would be represented. Said he, in reply: "The American District Telegraph Company propose making some illustration, and the Western Union have talked of it, but as yet there has been no comprehensive line of action marked out. I wish very much that some one of influence, willing to labor, would take this question up, for certainly in no other branch of science have there been such marvelous strides as in the direction to which you refer."

It astonished me to learn that so little had been done in the matter by electrical people, but I can hardly believe that an affair so national in its character, and in which almost every other known art and science will be so thoroughly and comprehensively illustrated, will be allowed to take place without an ocular demonstration of the rapid march of science in this direction being made. It is confidently expected that no less than half a million strangers will visit the city during the three days of the celebration; and invitations have been accepted by nearly every Governor, by government officials of high standing, by President Cleveland and his Cabinet, Cardinal Gibbons and many of the higher ecclesiastical personages, and by almost every foreign minister, and the consuls of the various nations. In fact, every one of importance has signified his or her intention of contributing their presence toward the success of the occasion, in response to the invitations issued by the Commission.

Governor Beaver has issued a proclamation asking that all labors be suspended during that time, and has, in other ways, with his influence, endeavored to make the occasion as nearly a holiday season as possible.

There is yet plenty of time for a thorough and complete electrical display, and it is sincerely hoped by the Commission and by every one connected with the movement that this important industry will yet claim the prominent part in the show it so richly deserves in the greatest display of a century. Any communications upon the subject may be made to Colonel A. Loudon Snowden, Chairman of the Committee, and Marshal of the Civic and Industrial Display, City Hall, Philadelphia, and they will receive prompt and careful attention.

The closing feature of the Centennial ceremonies on the evening of Saturday, Sept. 17, will be a grand commemorative banquet to President Cleveland, who has signified by letter his intention of being present. It is designed by those having it in charge to make it, without exception, the handsomest entertainment ever given in Philadelphia, a city renowned for the beauty and bounty of its festive celebrations. No expense or exertion will be spared to make it in every way worthy the event, the guests and the hosts.

It will be unique, perhaps, in the fact that it will be given by eight learned bodies, including the oldest societies on the American continent. The hosts will be the University of Pennsylvania, founded in 1749; the American Philosophical Society, 1743; the College of Physicians of Philadelphia, 1787; the Historical Society of Pennsylvania, 1824; the Academy of Natural Sciences of Philadelphia, 1812; the Pennsylvania Academy of Fine Arts, 1805; the Franklin Institute of the State of Pennsylvania, 1824, and the Law Academy of Philadelphia, 1783. On the occasion in question these institutions will entertain the President, the members of his cabinet, the representatives of foreign countries, the officers of the Army and Navy, the governors of the several States, the Constitutional Centennial Commission, and other distinguished men in art, science and literature. The provost of the University of Pennsylvania will preside at the banquet, which will be given at the Academy of Music.

The police patrol, which has been in use in a portion of this city for some time, has been pronounced an "expensive humbug" by Director of Public Safety Stokely, and his remarks on the subject have called forth a howl from all of the newspapers and hundreds of citizens who are writing to the papers letters favoring not only its retention, but its extension. As it is now operated there are not enough wagons or boxes, and it is to be hoped that councils will, at its next session, appropriate sufficient money to extend the system to all portions of the city, in which case the benefits of the system would at once become apparent. Incident to this subject I might mention that the authorities at Trenton, N. J., are advertising for proposals for the establishment of a patrol system in that city.

All of the daily papers are predicting one of the best business seasons this fall that the city has seen for some time, and I can add that this is particularly true of electric lighting and its kindred industries, which, even at this dull season, are "booming." E.

WESTERN NOTES.

BRANCH OFFICE OF THE ELECTRICAL WORLD,
CHICAGO, Aug. 27, 1887.

One of the prettiest suburbs of Chicago is called Edgewater, and, as its name indicates, it is near the lake and north of Lake View. The enterprising real estate dealer who controls this property has inserted a clause in all his contracts to the effect that incandescent lights must be used to the exclusion of all other illuminants. This action is important as showing the dependence that is being placed upon the incandescent light, as well as its superiority for lighting purposes. Apropos to the incandescent lighting, perhaps the best equipped isolated plant the Edison Company has in Chicago is the one just started in the Phœnix Building, corner Adams and Clark streets and facing the Grand Pacific Hotel. This structure has been built throughout upon a grand scale, even in comparison with other office buildings for which Chicago is noted, and the Edison Company doubtless proposed making this plant the model one of the city.

Through the courtesy of the chief engineer, Mr. J. G. O'Neill, I have been shown the entire steam and electric plant. The two engines used, running the three dynamos, are from the well-known firm of Messrs. Brown & Co., Fitchburg, Mass. In order that the power might be adjusted to suit all emergencies, a shaft has been placed at one end of the engine room which is driven by a belt transmitting power from the fly-wheel of the engine to the line shaft. By means of the ordinary jaw or "four finger" clutch each or any number of the dynamos can be set in action at will. Every foot of the building is wired with "Kerite," and the belting is from Munson & Co. The entire arrangement of the electric plant was made under the supervision of Mr. F. Sargent, of the Edison Company, and designed by Messrs. Leonard & Izard of this city. One of the steam pumps in this building has a capacity of two million gallons, large enough, by the way, to furnish a city the size of Elgin, Ill., with its entire water service. The heating is done by the exhaust steam from the electric light engines. This same plan will be adopted in the Rookery Building, and is meeting with favor as being so economical. The only trouble with this scheme is the back pressure which the engine sometimes gets, in

which case it is necessary to let off the surplus into the air by means of a pipe running to the roof. This is now done by hand power, but it is probable that an automatic device will be adopted for this purpose.

The city of Kenosha, Wis., has the street-lighting question under consideration, and will doubtless adopt the electric light.

The ordinance giving the Van Depoele Company the privilege of putting in six miles of road at Lake View has passed the Council, and operations will be begun at once.

I am glad to announce that a company is forming for the purpose of supplying temporary electric lighting, both arc and incandescent. There is quite a demand for this kind of service in this city, as in the case of the coming International Encampment and the Siege of Troy, now being held at the Base-ball Grounds, which latter, by the way, is lighted by the Van Depoele arc lights and incandescents by Electrical Accumulator Company's batteries from Johnson, Holland & Co.

The Chicago Electric Club held a meeting Monday, July 22, in its rooms at 225 Dearborn street. The paper for the evening's discussion was read by Professor Badt upon "The Dangers to Human Life by Electricity," and largely commented upon. The paper bore evidence of great research and a thorough understanding of all the points at present known regarding the subject. There are indications looking toward the acquirement of suitable apartments for club purposes with library, reading rooms, etc.

Trouble has resulted over the award made some time ago of the electric light franchise at Racine, Wis., and several suits have been brought in consequence.

The local telephone company is making efforts to prevent the electric light companies from putting wire on the telephone poles at Evanston, Ill.

I have received the following from Indianapolis, Ind.: The threatened suit against the Central Union Telephone Company was begun yesterday in the Superior Court of Indianapolis by Attorney General Michener. The complaint is based on the statute enacted in 1881, in which it is provided that telephone companies organized outside of Indiana but doing business in her borders shall annually report to the Auditor the gross amount of earnings for the year immediately preceding April 1. The act also provides that companies shall pay to the Treasurer of the State 25 cents on each $100 of the gross receipts. Upon failure to make report and payment the statute provides that the corporation shall forfeit to the State $10 for each day such report is delayed. The Central Union has never made report nor paid tax since 1882. This suit is brought for the entire amount of the forfeiture—$40,000. The telephone company will plead the unconstitutionality of the law. The Attorney General has an agent looking into the affairs of the Chicago company which operates in Northern Indiana. It is reported to be liable under the law cited. The Cumberland company, operating in Southern Indiana, has paid the required assessments.

The telephone company's troubles in South Bend, Ind., seem to be on the increase. Last week the Street Commissioner, by order of the City Council, began cutting down the poles and wires, and heavy damage was done before an injunction could be served. As stated before in these columns, the whole trouble lies in the unwillingness of the people to adopt the toll system, which, they allege, costs more than the legal rate.

The Central Electric Company of this city has secured the contract to supply annunciators for a hundred room hotel at Fargo, Dakota. The Hess system will be used.

Quite a novel method has been adopted by a large steamship line here for giving the captain better control over his boat. A three wire lead cable has been run from the pilot house to the engine room, where it is so adjusted that the way the screw is running is known by the ringing of one of the three bells in the pilot house, so that in case of a mistake by the engineer as to the signal it is at once known to the pilot. A large amount of damage has been done in the Chicago River by engineers mistaking signals, and the wonder is that something of this kind was not thought of before.

An acoustic telephone has been placed in a Chicago diver's helmet for use in communicating to the boat from which the diver descends.

Col. S. G. Lynch, broker, 146 La Salle street, Chicago, furnishes me the following quotations upon telephone stock:

Bell of Mo.	$155@$157
Central Union	44@ 45
Chicago	385@ 400
Colorado	20@ 22
Cumberland	80@ 85
Great Southern	30@ 33
Iowa Union	25@ 27
Michigan	75@ 76
Rocky Mountain Bell	45@ 45
Wisconsin	105@ 107

C. H. M.

THE TELEGRAPH.

Janesville, Wis., is to have an electric fire alarm system.

Newark, N. J., is to have an addition to its fire-alarm system, and the Gamewell, Richmond and Union companies are on the ground in competition.

Augusta, Ga., has established an electric fire alarm system and a paid fire department, and the extra insurance rate of 15 per cent. on dwelling-house risks there is taken off.

Postal Wires in Chicago.—A Chicago dispatch says that the Postal Telegraph wires have been ordered out of the board of trade in that city because it furnished bucket shops with commercial news department service.

Cleveland, O.—It has been proposed to separate the city fire and police department telegraph systems in Cleveland, but the expense of separate operation and management stands in the way. Some changes, however, will probably be made.

Fire Alarm.—The United States Electric Fire Alarm Company, of Evart, Mich., has elected the following officers: W. R. Mapes, President; E. C. Cannon, Vice-President; F. A. True, Secretary; D. Wolf, Treasurer, and S. A. Chase, Electrician.

Train Telegraphy.—The Consolidated Railway and Telegraph Company is building a telegraph line from Easton, Pa., to Perth Amboy along the Lehigh Valley Railroad, and is using twenty-foot poles. This line is to take the place of the line laid between the rails by the Phelps Induction Telegraph Company last winter, and used for telegraphing from moving trains.

Mexican Telegraphs.—The earnings of the Mexican Telegraph Company for the week ending Aug. 20 were $4,901, and of the Central & South American $7,283.

Telegraphing in China.—The Chinese Government officials have lines of wire from Shanghai to the north and south well established and in good working order. With regard to the difficulty of telegraphing, as stated in a paper that published an interview with Captain Brady, of Philadelphia, that, says the San Francisco *Chronicle*, is all nonsense. Since 1873 there has been a cable between Hong Kong and Shanghai. Other lines are in working order, and there has never been any difficulty experienced by the Chinese in sending messages. It requires about 7,000 characters to conduct the every day ordinary transactions in Chinese mercantile affairs. A book containing these characters, numbered from 1 to 7,000, has been printed by the telegraph authorities, and if a man wants to send a message he simply wires numbers representing the characters, and the receiver marks down the number at his end of the line. Reference is made to the book and the characters are ascertained. This system has been working for the past thirteen years and has given satisfaction to the Chinese.

To Offset Wire Tapping.—A dapper young fellow, wearing fashionably good clothes, and lounging idly about the Long Branch hotels during the forenoons and evenings, is never seen at the shore afternoons. He is then at the races, and has curious employment there. Four times in as many years have the pool sellers and bookmakers of New York City been swindled by false reports of the races. Shrewd rascals have tapped their private wires, forwarded wrong names, and so led them to pay heavily on tickets previously bought by confederates. This year the turf gamblers have joined in self-defense. The young man is employed to telegraph in cipher, independent of all other reports, the names of the winning and placed horses in every race. Until his secret dispatch is received no money is paid out on tickets in any New York pool room. He was chosen for the service very carefully, and is paid a good salary, for it is in his power to mislead his joint employers ruinously; and to further guard against his falsity, he and his friends deposited $5,000 with a committee, the money to be forfeited in case he plays a trick. They went to the indemnity companies to have him bonded, as banks now do with their cashiers, but he was regarded as extra hazardous, and was promptly declined, without thanks.

THE TELEPHONE.

Milwaukee, Wis.—The Wisconsin Electric Manufacturing Company, incorporated by A. Willer, W. J. Roberts and A. A. Hopkin, with a capital stock of $150,000, proposes to build and operate a telephone exchange in Milwaukee.

The Telephone in England.—The National Telephone Company, Limited, has just held its seventh annual meeting. It reports a total gross revenue of $450,000, or $55,000 more than last year, and has voted a dividend of 6 per cent. per annum on the first preference stock, for the six months ending June 30, 6 per cent. on the second preference stock, and 4 per cent. on the ordinary stock. The company proposes to carry out plans for connecting together all the exchanges in its extensive system in the North of England.

Bristol to Swansea.—Mr. H. F. Lewis, the secretary and general manager of the Western Counties & South Wales Telephone Company, is now operating successfully a long distance line from Bristol to Swansea. The talking distance is 116½ miles. Telephony is growing in favor in the west of England, and Bristol now has 400 subscribers; Bath, 33; Plymouth, 177; Portsmouth, 110; Cardiff, 43; Newport, 23; Torquay, 97; Bournemouth, 152; Swansea, 116; and Southampton, 64. The newer exchanges at Weymouth, Gloucester and Exeter are doing well. Of trunk lines there are now 232 route miles and 569 miles of wire.

Bell Telephone.—The returns of the Bell Telephone Company for the month ended Aug. 20 show an increase in gross over 1886 of 486, and a decrease in net of 104. The returns for the month were heavy, being 3,353, leaving the net gain for the month 180. Comparative figures follow:

Month, Aug. 20.	1887.	1886.	Increase.
Gross output	3,533	3,047	486
Returned	3,353	2,763	590
Net output	189	284	*104
Since Dec. 20.	1886-7.	1885-6.	
Gross output	36,541	27,961	8,580
Returned	17,663	13,407	4,256
Net output	18,878	14,554	4,324

* Decrease.

THE ELECTRIC LIGHT.

Seneca, Kan., is to be lighted by electricity.

Edwardsville, Ill., has granted a franchise for electric lighting to local parties.

Nickerson, Kan.—Mr. P. E. Newton has secured a franchise for electric lighting at Nickerson.

Evansville, Wis.—The plant at Evansville is to be in operation by the middle of the month.

London, Ont.—Twenty additional arc lights are to be put up for the city at once, for street lighting.

Pine Bluff, Ark.—The Pine Bluff, Ark., Gas Company will, it is said, enlarge its electric light plant.

Raleigh, N. C.—The Raleigh Oil Mill & Fertilizer Company have ordered an electric light plant for their works.

New Orleans, La.—The bids for lighting the city public buildings with arc and incandescent lights were received this week.

Nashville, Tenn.—The Brush Electric and Power Company at Nashville will have a 650-light Westinghouse alternating machine in operation by Oct. 1. As already stated in these columns, the company has secured the services of Mr. J. Wills, of Auburn, N. Y., who is now building a new switch-board and overhauling the large Cummer engine.

Stillwater, Minn.—The Stillwater Gas Company has become the Stillwater Gas and Electric Light Company. Its capital stock is $60,000.

Yankton, Dak.—A contract has been made for an Edison plant for the Insane Hospital at Yankton, and the building is now being wired for 300 lights.

Newark, N. J.—The Schuyler Company has obtained power to put its wires underground, and the resolution passed is very broad and liberal in its terms.

Brainerd, Minn.—The Brainerd Electric Light Company has been incorporated by J. C. Rosser, W. E. Seelye and others, with a capital stock of $100,000.

Mt. Vernon, Ill.—The Mt. Vernon Electric Light and Power Company, Mt. Vernon, Ill., has been incorporated, with a capital stock of $400,000, by Fred. A. Bell and others.

Lucca, Italy.—An installation of about 200 incandescent lamps on the Zipernowski-Dèri system has been put up at Lucca, power being obtained from a river about three miles distant.

Ironton, O.—The Sarah Furnace, at Ironton, has been equipped with an electric light plant, consisting of a 25 horse-power Westinghouse engine, a 45-light Schuyler dynamo, and twenty 1,200 c. p. lights.

Genoa, Italy.—It is stated that the Ganz Company is now negotiating for the concession of a large central station at Genoa, where it will put in the alternating system, using Zipernowski-Dèri transformers.

Lava Ware.—The D. M. Stewart Manufacturing Company has been incorporated at Chattanooga, Tenn., by D. M. Stewart and others, with a capital stock of $30,000, to manufacture lava electric insulators, etc.

Boston, Mass.—In digging trenches for electric light mains in Boston, the laborers have unearthed some old graves on Boylston street, opposite the public library. A cry of desecration has been raised because of the sale of skulls and bones by the men to passers-by.

San Paulo, Brazil.—An alternating current plant of the Zipernowski-Dèri system, consisting of 1,000 lamps is now being constructed at San Paulo. Edison lamps of 16 c. p. are to be used, together with arc lamps. It is stated that overhead bare conductors will be strung.

Woodhouse & Rawson.—The large London house of Woodhouse & Rawson is now being formed into a limited liability company, which will have a capital of a million dollars. The patents, etc., owned by the concern are valued at $750,000. Mr. Rawson is to be retained as managing director for five years.

Indianapolis, Ind.—The Indianapolis Jenney Company is putting a large plant, including 60 arcs, in the beautiful new Union Depot at Indianapolis, and has just issued a fine, large chromolithograph of the building. In one corner of the sheet, which is mounted on rollers, is a view of a city lighted by the company's tower system.

Oswego, N. Y.—The Oswego Gas Company, Mr. W. Cartwright, general manager, intends, as stated recently, to go into the electric lighting business. It is now installing a plant of 650 incandescent lamps and 35 arc lamps of the American system. For the incandescents, the Edison system is to be used, and two 350-light Edison machines will be operated.

Uniontown, Pa.—The Mather Electric Company, represented by Messrs. Ela & McKay, have finished wiring the Westmoreland Paper Company's mills and offices at West Newton, Pa. A 300-light machine is placed on the first floor, and will feed at present 265 lights of 16 c. p. Callender waterproof and fireproof wire is used largely throughout the installation. When completed, the plant will be one of the finest in that part of the State.

The Edison Municipal System.—The following plants, operating Edison "Municipal" lamps by high-pressure currents over long distances, are in the hands of Edison and other illuminating companies, and used principally for street lighting: Lockport, N. Y., 200; Portland, Me., 900; Lawrence, Mass., 900; Jacksonville, Fla., 400; Denver, Col., 900; Lachine Canal, Canada, 600; Seattle, W. T., 750; Tacoma, W. T., 250; Boise City, Idaho, 450; Attica, Ind., 250; Brockton, Mass., 450; Saratoga, N. Y., 200; Vancouver, B. C., 250, making a total of 6,500 lamps.

Graphite Carbon for Electric Lighting.—According to *Engineering*, Mr. H. N. Warren, an English investigator, has succeeded in producing a very dense graphitoidal carbon for incandescent electric lighting by passing the discharge from an induction coil through a vessel containing coal gas. The graphite forms on the end of the negative electrode and lengthens out toward the positive electrode if the latter is withdrawn from the negative electrode. The carbon burns without residue in oxygen. Mr. Warren is engaged in experiments with mixtures of coal gas and silicion fluoride or boron fluoride, in order to obtain a denser carbon mixed with silicon or boron, but hitherto has not been entirely successful.

Cheap Line Construction.—The following is from the Geneva (N. Y.) *Gazette* of Aug. 12: On Friday last, while driving through the village of Waterloo, Mr. Charles H. Avery, manager of the Geneva Electric Light Company, and Mr. Cushing, attorney for the Brush Company, of Cleveland, met with a serious accident. In order to economize in the matter of posts, it seems that the Electric Light Company, of Waterloo, had strung its wires on the trees, crossing and recrossing the street at various places to escape contact with the foliage. In some manner one of the wires became loose and dropped down to within seven or eight feet of the ground. Messrs. Avery and Cushing, being engaged in conversation, did not notice this state of affairs, and the wire caught the top of the buggy. The peculiar noise of the wire grating on the buggy frightened the horses and they started to run. This tore off the top and threw the occupants out. Mr. Avery struck on his head, sustaining severe bruises just over his right eye and near the temple, and it is a wonder that he was not killed. Mr. Cushing fell on top of Mr. Avery and received only a sprain in the wrist. The buggy was demolished.

APPLICATIONS OF POWER.

Dallas, Tex.—An electric railway is to be put in operation on the grounds of the Dallas Exposition.

Findlay, O.—It is understood that a contract has just been closed for the electric road at Findlay.

The Sprague Car for Boston is now nearly ready, and is receiving its equipment of Julien batteries.

Mansfield, O.—The Daft electric railway at Mansfield has gone into operation, starting off with two cars.

Carlsbad.—It is proposed to build an electric tramway at Carlsbad, and a concession has already been obtained for the purpose.

Georgia.—A bill is before the Georgia Legislature to authorize the Georgia Electric Mining and Improvement Company to build branch railroads.

Brooklyn, N. Y.—The Brooklyn, N. Y., & Jamaica Plank Road Railroad Company has contracted with the Van Depoele Electric Manufacturing Company for an electric railway, but is having some trouble with the local authorities as to the title to the road.

Pittsburgh, Pa.—The Daft Company has shipped to Pittsburgh the first motor intended for the Daft road there. It is a motor of no less than 35 h. p., and is built to make use of both overhead and underground conductors. In the populous parts of the town it derives current from a conduit, and then it utilizes the overhead wire with the ordinary trolley. This motor has to surmount grades of 14 per cent., and there employs a sprocket wheel engaging with a perforated rail, the wheel being raised and lowered at will. The car is provided with electric lights and gongs and has an arrangement for introducing variable resistance, so as to control the speed of descent. The motor weighs six tons.

Worcester, Mass.—The *Practical Mechanic* in the course of an interesting article on electric railways says: "Worcester will not long be content to allow other centres to surpass her in this manner. The applicability of electric power not only to railway cars but to a great variety of mechanical and industrial purposes, was fully demonstrated by the recent electrical exhibition in this city, and a failure to adapt it to some of the public practical purposes for which its fitness has thus been proved, will signify a lack of disposition or effort. Worcester people will not only desire to ride to Lake Quinsigamond and back by electric power, but they will soon clamor for the reason why they are not able to enjoy the same facilities for street travel which vastly inferior cities are successfully adopting."

It Lays Hold on the Future.—The Boston correspondent of the *Springfield Republican* says, with regard to the motors shown at the recent electric light convention: "It seems reasonable to suppose that electrical inventions will share with railroads in future the preference of trustees and saving institutions for investments of hoarded money, with, of course, an equal or greater chance of loss. It was an inspiration to see the whizzing machinery to-day. It was my good fortune to be in the private shop of Prof. Bell in 1876 when he made some of his telephone experiments in talking with Providence, and later, to hear the experiments publicly repeated in Music Hall. Then it was a matter of curiosity. To-day the telephone is indispensable. So this display of power transmitted by wire from a central station seems to take an equal hold on the future. All the circumstances point to the opening of a new and great field for invention, capital and service to the wants of man. In the electric motor is a promise of good things made cheaper, life of working prolonged, labor lightened and brain strengthened by the relaxation of the strain on the bodily powers to keep up the struggle for a living."

PERSONALS.

Dr. Otto A. Moses has gone to Europe on business.

Mr. Wm. Bracken, president of the Julien Electric Company, has gone to Europe in the interests of that corporation.

Dr. A. R. Ledoux, speaking of underground work in Europe, says: "While abroad I inspected and carefully studied the subterranean electrical work in London, Paris and Brussels. I find that London is, after all, 'the mother of conduits.' They have been using iron pipes to string wires, but they are now thinking of getting insulated conduits. The whole question of subway construction and subterranean conduits for electrical purposes is, after all, yet in its infancy, and the more we can ascertain its working under various climatic influences the better for all of those charged with enterprises of this kind."

MISCELLANEOUS NOTES.

"Cofferdam."—The August number of *Mechanics* contains an interesting article by Lieut. W. H. Beehler, U. S. N., on "Cofferdam," or cellulose for galvanic batteries. We have already published some descriptive articles on this subject.

A Pleasant Excursion.—There will be an excursion, under the auspices of the Electrical and Photographic Sections of the American Institute and the Society of Amateur Photographers of New York, to-day, Sept. 3. The commodious steamer "Blackbird" has been engaged, and will leave the foot of Franklin street, North River, at 9½ A. M. sharp, cruising around the waters of New York until 1 P. M., when she will land at the foot of Thirty-first street, East River, for the accommodation of those unable to start in the morning, and will then proceed to Glen Island, where a dinner will be provided. Gentlemen's tickets $2 each, including dinner, and ladies' tickets, $1, can be procured at the American Institute, Clinton Hall, Eighth street, or at the office of the secretary.

Sudden Changes in Wire Tension.—The production of sudden changes in the tension of a wire by change of temperature, was treated recently in a paper read by R. H. M. Bosanquet, before the British Physical Society. A very fine hard-drawn platinum wire, four or five feet long, was used as a suspension for a ballistic galvanometer, and exhibited peculiar phenomena. The steel needles were replaced by brass ones, and the peculiarities investigated. When the room was warmed the needles swung round nearly 70 degrees for a few degrees' rise of temperature, and remained in about the same position for further rises. If it was now cooled a few degrees—3 degrees or 4 degrees F.—they quickly returned to their initial position. The author has not found a complete explanation, but believes it to be due to unequal expansion and loose contact among molecules.

BUSINESS NOTICES.

Jordan & Gottfried, 208 Canal St., N. Y., carry a complete stock of iron and brass machine and wood screws, bolts cap and set screws, taps, dies, files, twist drills, brass and rubber in tubing, rod and sheet copper, brass, German silver, steel and iron wire, shafting, tools, etc.

Change of Firm.—The partnership heretofore existing under the name of Kimball & Davis, of Boston, has been dissolved, Mr. F. E. Davis retiring. The business will be carried on hereafter by F. M. Kimball, under the name of Fred. M. Kimball & Co., 103 Merrimac street, Boston. The dynamo made by the concern was illustrated in our last issue.

STOCK QUOTATIONS.

The following list, compiled by Mr. W. H. Baker, member New York Stock Exchange, 16 and 18 Broad street, gives the current quotations of electrical stocks:

Aug. 30, 1887.

TELEGRAPH.	Bid.	Asked.
Am. Dist.	.....	37
Am. Tel. & Cable	70	71½
Cen. & So. Am.	100	110
*Com. Tel	.....	.....
*Gold & Stock	.....	.....
*Inter. Ocean Tel.	.....	.....
N. Y. Mutual	72	76
Pac. & Atl.	49	56
*Postal T. & C.	30	.....
South. & Atl.	72	80
W. U. Tel.	70⅝	70½
W. U. Scrip	.....	.....
W. U. Bonds	116½	.....
Mut. U. Bonds	83	84½
TELEPHONE.		
Am. Bell	208	210
Am. Speaking	105	120
Erie	34	34½
*Hudson River	.....	57

TELEPHONE.	Bid.	Asked
Mexican	1	1¼
*N. Y. & N. J.	.....	92
N. Y. & Pa.	.....	.....
New England	41	42
*Southern Bell.	125	130
ELECTRIC LIGHT.		
*Am. Electric	33	42
*Brush	89	.....
*Brush Ill	89	.....
*Consolidated	.....	.....
*Daft	.....	.....
*Edison	.....	205
*Edison Ill	85	.....
*Edison Isolated	.....	.....
*United States	43	.....
*U. S. Ill	.....	92
MOTOR.		
*Daft	.....	.....
*Sprague	.....	.....

* These stocks are so seldom dealt in that it is difficult to give prices at which they can be bought or sold. The figures given are as near as can be ascertained.

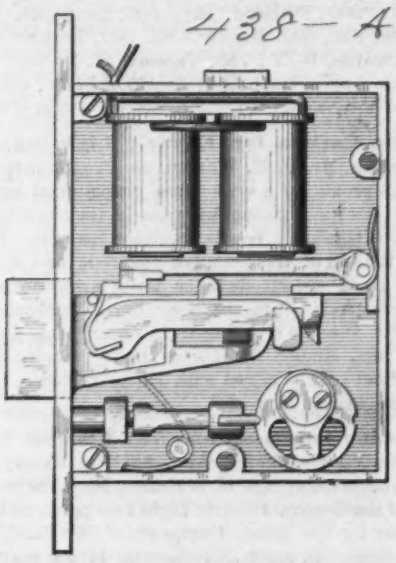
OUR ILLUSTRATED RECORD OF ELECTRICAL PATENTS.

PATENTS DATED AUGUST 16, 1887.

(1) **368,190. Art of Converting Chemical Energy into Electrical Energy**; (2) **368,191. Galvanic Cell**; W. E. Case, of Auburn, N. Y. Application filed April 20, 1887. The principle consists in producing an electrical current by chemically attacking carbon without imparting heat to the carbon or to the cell from any extraneous source. For description see page 132 this issue.

368,195. Electrical Piano; G. F. Dieckmann, New York, N. Y., Assignor of one half to Paul Gmehlin, same place. Application filed March 2, 1885. Magnets are placed in proximity to the metallic strings of a piano, and when a vibratory current is sent through a magnet, the corresponding string is caused to vibrate and give out its sound.

368,212. Electric Lock; T. B. Hornaday, Indianapolis, Ind., Assignor to the Yale & Towne Manufacturing Company, of Stamford, Conn. Application filed March 29, 1887. By means of an electric circuit a series of locks constructed according to this invention may be unlocked simultaneously. See illustration.



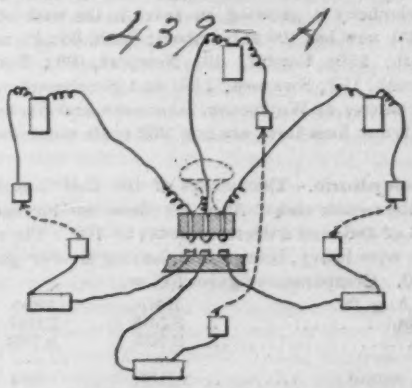
368,212. ELECTRIC LOCK.

368,217. Printing Telegraph; J. H. Linville, Philadelphia, Pa. Application filed Oct. 4, 1886. The object is to diminish the cost, increase the rapidity of operation, to obviate the necessity of winding the motive power by hand and other details.

368,221. Circuit-Changer; C. W. McDaniel, Kansas City, Mo. Application filed Feb. 17, 1887. Two segmental metallic strips, separated by insulating material, the plates being pivoted and forming the terminals of a loop circuit. They are adapted to swing and make contact with either of two sets of terminals.

368,265. Electro-Mechanical Brake; G. T. Woods, of Cincinnati, O., Assignor to the Woods Electric Company, of same place. Application filed Nov. 3, 1886. This invention consists in the construction and arrangement of mechanism and mode of applying and controlling the electrical power used.

368,284. Electric Wire Clamp Insulator; J. R. Fletcher, Dayton, O. Application filed Dec. 22, 1886. A metallic frame in two parts, which embraces a divided porcelain insulator having longitudinal grooves in which the conductors are supported.



368,342. TELEGRAPH KEY.

368,315. Means for Dissipating Electricity for Printing Machines; L. E. Bathrich, Brooklyn, N. Y. Application filed May 4, 1887. A grounded electrical conductor is arranged in the path of the paper and carries off the generated current.

368,321. Battery-Connection for Electric Conductors; P. Bowe, Jersey City, N. J. Application filed May 3, 1887. A screw connection having a broad flat head split or slotted in the direction of its diameter, or greatest width, to form clamping jaws.

368,336 Burglar Alarm; A. E. Hathaway, Needham, Mass. Application filed Nov. 18, 1886. This device is to be used on windows and doors, and the invention consists in the details of construction. See illustration.

368,342 Telegraph Key; D. Kunhardt, Aachen, Prussia, Germany. Application filed March 29, 1887. This key is provided with multiple contacts for sending a message simultaneously to several stations. See illustration.

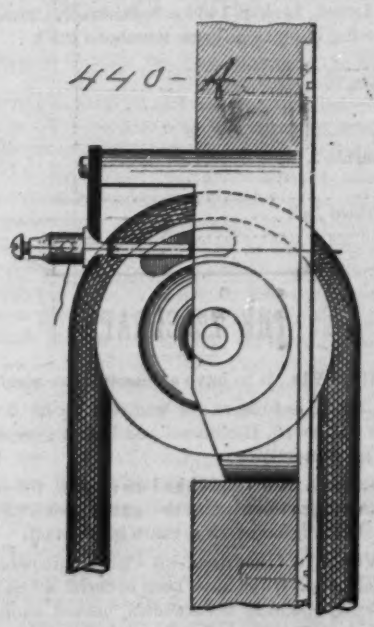
(1) **368,405. Electric Rock Drill**; (2) **368,406. Electric Rock Drill**; H. N. Marvin, Syracuse, N. Y. Applications filed respectively Jan. 28 and Feb. 1, 1887. These inventions provide for cushioning the stroke of the drill at the end thereof and for properly turning the tool at each stroke.

368,411. Synchronal Motor for Electrical Type Writers; J. F. McLaughlin, Philadelphia, Pa. Application filed April 1, 1887. The invention is applicable for use in any instance wherein it is necessary to maintain synchronal action between two or more rotating shafts of any preferred form of motor, which are placed, respectively, at two or more terminals of a line circuit.

368,450. Telegraphic Transmitter; W. H. Bloom, Galt, Ill. Application filed March 26, 1887. Means whereby an operator can send messages as fast as he can receive them.

368,512. Railway Signal; G. D. Burton, of Ipswich, N. H., and C. H. Magoon, of St. Johnsbury, Vt., said Magoon assignor to said Burton. Application filed June 23, 1886. The alarm circuit is completed by pulling cords which are attached to bell cranks. The movement of the cranks causes two contact plates to come together.

368,541. Printing Telegraph; Henry Mahnken, of Brooklyn, Assignor to The Commercial Telegraph Co., of New York. Application filed Feb. 1, 1887. A pole-changing transmitter and two or more polarized relays operated thereby, and two or more type-wheel lines controlled by such polarized relays, the local and line circuits on such relays being protected against cross-connection.



368,336. BURGLAR ALARM.

368,546. Electric Belt; A. Owen, St. Louis, Mo. Application filed Aug. 16, 1886. Great intensity and power in proportion to its compactness is the object of this invention.

Copies of the specifications and drawings complete of any of the patents mentioned in this record—or of any other patents issued since 1866—can be had from this office for 25 cents. Give the date and number of patent desired, and address Johnston's Patent Agency, Potter Building, New York.